NASA CENTER EMS IMPLEMENTATION GUIDE

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NASA CENTER EMS IMPLEMENTATION GUIDE

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INTRODUCTION

This document was developed to provide guidance on EMS implementation at NASA Centers. The guide includes consideration of and notes from the experience gained through the test bed EMS implementation process conducted at Glenn Research Center, Johnson Space Center and Stennis Space Center.

The EMS implementation process consists of three basic phases:

1. **Pre-Implementation**, consisting of overall EMS design and preparation activities that can be conducted prior to "roll out" of the EMS across a Center at large.

2. **Implementation**, over about a one-year time period, consisting of the activities and processes involved in ensuring that all elements of the EMS as required under NPG 8553.1 are developed and implemented at a Center. If ISO 14001 registration is a goal, additional activities associated with ISO 14001 registration may need to be included in the implementation phase. ,

3. **Maintenance**, consisting of activities typically required to ensure ongoing EMS functionality and to facilitate continual improvement. If ISO 14001 registration is obtained, additional activities may be required for maintenance of ISO 14001 registration.

Note: At this time no examples of how EMS maintenance has been accomplished at NASA Centers is available. With the three test bed Centers moving to EMS maintenance in 2001, in the future additional NASA specific experiences will become available.

This guide provides suggestions on the timing, sequencing, and activities associated with the steps and procedures that a Center should follow to ensure successful EMS deployment. This guide and the associated tools in Appendices A and B and examples from the Test Bed Centers will assist a Center in preparing an EMS Implementation Plan to accomplish all of the activities necessary to implement an EMS. Each section of the guide identifies duration and timing considerations separately from the suggested activities.

The guide is organized along the lines of five suggested functional areas. One of these areas reflects the core process of EMS Element Execution, while the remaining four are support functions that enable more rapid and effective EMS deployment by involving a wider array of Center personnel and by delegating responsibility appropriately across the organization. The four support functions for EMS Element Execution include the following:

- Coordination.
- Training/Awareness.
- Operational Support, and
- Administration.

Each functional area has recommended activities that interact with other functional areas at points in the process. In addition, this guide includes suggestions for a smoother implementation process and case studies of organizations that have successfully implemented an EMS.

This implementation guide is not a stand-alone document. It refers extensively to NPG 8553.1, NASA Environmental Management System (EMS) Procedures Manual (EMSPM). Refer to the NPG for additional information on references, definitions, acronyms and abbreviations.

Implementation Flow Chart

The Flow Chart provides an overview of the EMS implementation process. The Flow Chart identifies the implementation steps that typically are required in sequence based on a one-year EMS implementation period (for different implementation time periods, proportionally adjust the time lines). Centers should use the Flow Chart to identify steps to be included in their Center-specific plans. Each Center should determine to what degree steps included in the four functional support areas should be part of the Center's EMS Core Team role or be delegated. When tasks are assigned outside the EMS Core Team's direct control, communication on progress and resolution of issues should increase to ensure that issues are identified and resolved in an effective and timely manner.

This Flow Chart is not a definitive listing of all activities that might arise during the implementation process, but rather is a reminder of those activities that often are associated with a particular phase of implementation. Both the activities and time line may be subject to significant adjustments to accommodate the unique situation at each Center.

Functional Area Gantt Charts

Gantt Charts depicting EMS element execution and each of the four potential functional support areas follow the Flow Chart. Each Gantt Chart lists the steps and recommended activities for the functional area as outlined in the Flow Chart depicting the recommended time periods for the pre-implementation and implementation phases. The EMS maintenance component of the process also is noted where appropriate. The timing suggested in each Gantt Chart should be used only as a general guideline or benchmark for EMS implementation over a one-year time period. The actual time required to progress along the suggested steps will vary among Centers.

Implementation Checklist and Template

Appendixes A and B contain a Checklist and a Template respectively to aid in the implementation process. The Checklist is primarily a record-keeping tool that provides a single location for the names of those persons responsible for completing each implementation activity and when it was accomplished. The Template is a more detailed version of the checklist outlining specific implementation activities. Both the Checklist and the Template track the implementation Flow Chart and were developed to assist Centers in determining the different activities that should be performed during the pre-implementation and implementation processes. As neither tool was designed to fit every situation they are intended to be flexible and may be modified as needed by a Center

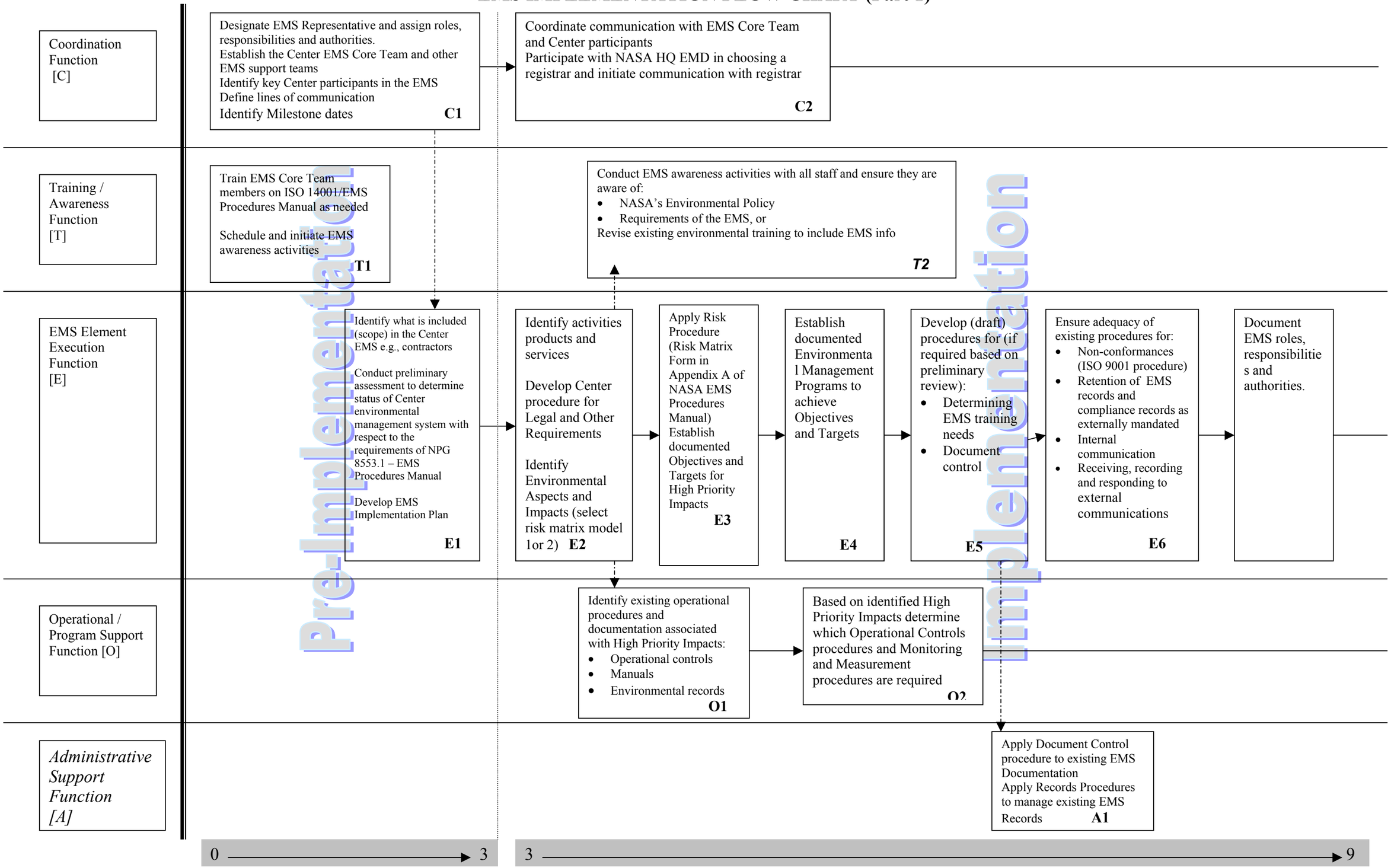
Implementation Plans From the Test Beds

Appendixes C, D and E contain the EMS implementation plans from the three test bed Centers that began EMS implementation using the first version of this guide in 2000. Each Center adapted the guidance in this document to create a custom approach to it's EMS development process. The resulting plans provide examples of how detailed plans and EMS implementation will vary between Centers.

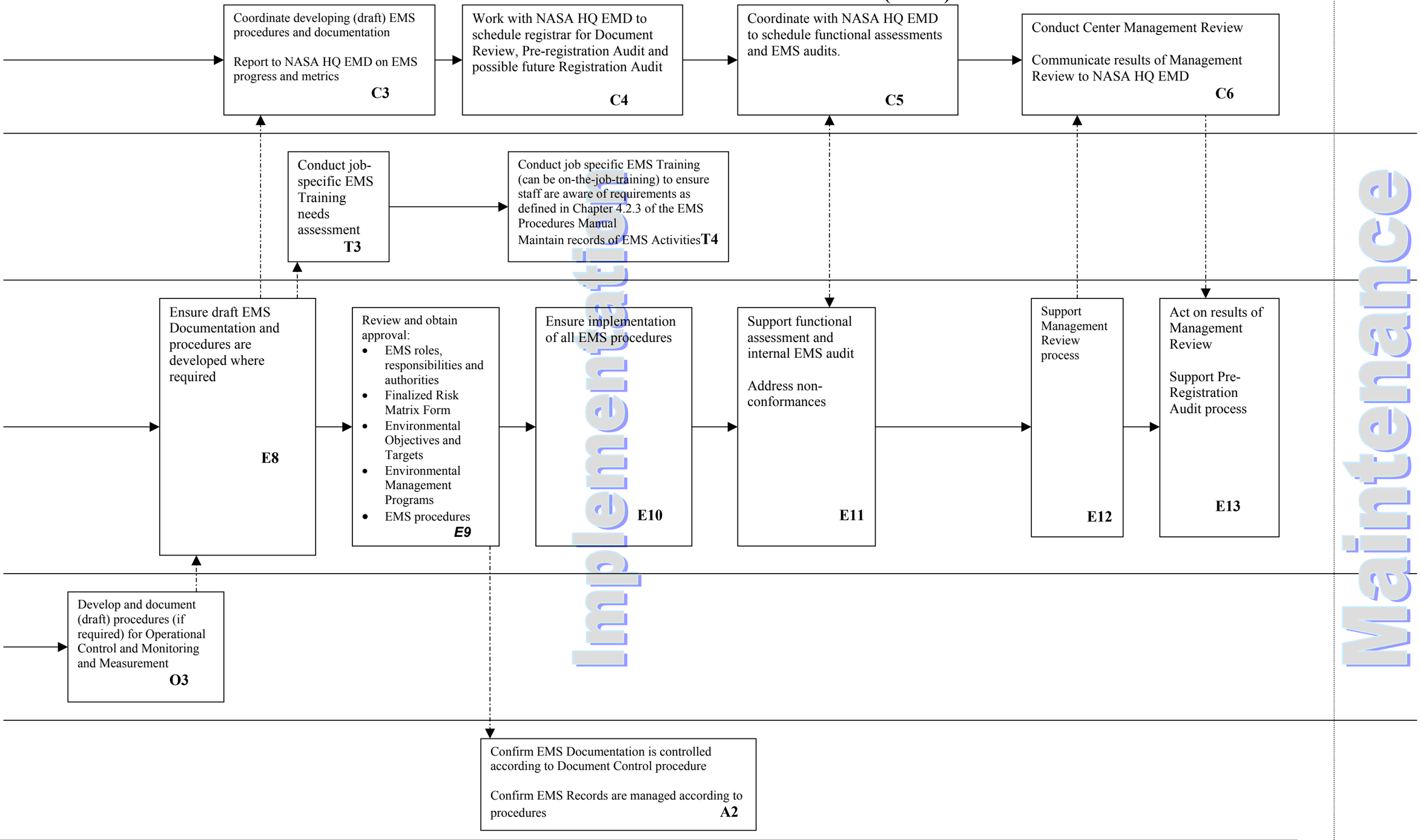
Lessons Learned

Appendix F contains a summary of lessons learned by the three test bed Centers and the NASA core team over the life of the test bed program.

EMS IMPLEMENTATION FLOW CHART (Part 1)



EMS IMPLEMENTATION FLOW CHART (Part 2)



Coordination Function Activities	**Elapsed Time in Months**																
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**++**
Designate EMS Representative **[C1]**																	
Establish EMS Functional Teams **[C1]**																	
Identify key Center participants in the EMS **[C1]**																	
Define lines of communication **[C1]**																	
Identify Milestone dates for EMS documentation **[C1]**																	
Coordinate communication processes **[C2]**																	
Participate with NASA HQ EMD in choosing a registrar, if desired [**C2]**																	
Coordinate development of EMS procedures and documentation **[C3]**																	
Report to NASA HQ EMD on EMS progress and metrics **[C3]**																	
Work with NASA HQ EMD to schedule registrar **[C4]**																	
Coordinate with NASA HQ EMD to schedule EMS audit **[C5]**																	
Conduct Center management review **[C6]**																	
Communicate results of management review to NASA HQ EMD **[C6]**																	
Ensure resources allocated to address non-conformances **[M]**																	
Work with NASA HQ EMD to schedule surveillance audits **[M]**																	

Pre-Implementation

Implementation

Maintenance

Training/Awareness Function Activities	**Elapsed Time in Months**																
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**++**
Train Center EMS Core Team members [T1]																	
Schedule and initiate EMS awareness activities, or Revise existing environmental training to include EMS info. [T1]																	
Conduct EMS awareness activities with all staff **[T2]**																	
Conduct EMS job-specific training needs assessment **[T3]**																	
Conduct job specific EMS training **[T4]**																	
Maintain records of EMS training **[T4]**																	
Based on revised high priority Impacts identify training requirements **[M]**																	
Develop plan to conduct training **[M]**																	
Develop training materials **[M]**																	
Maintain EMS training records **[M]**																	

Pre-Implementation

Implementation

Maintenance

Center EMS Core Team Activities	**Elapsed Time in Months**																
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**++**
Identify what is included in the Center EMS **[E1]**																	
Conduct preliminary assessment **[E1]**																	
Develop EMS Center implementation plan **[E1]**																	
Identify activities products and services **[E2]**																	
Develop Center procedure for legal and other requirements **[E2]**																	
Identify environmental aspects and impacts **[E2]**																	
Apply risk procedure **[E3]**																	
Establish documented objectives and targets for high priority impacts **[E3]**																	
Establish documented environmental management Programs **[E4]**																	
Develop procedures for EMS training needs and document control **[E5]**																	
Ensure adequacy of existing procedures **[E6]**																	
Document EMS roles, responsibilities and authorities **[E7]**																	
Ensure draft EMS documentation and procedures are developed where required **[E8]**																	
Review and obtain approval **[E9]**																	
Ensure implementation of all EMS procedures [**E10]**																	
Support functional assessment and internal EMS audit **[E11]**																	
Address non-conformances [**E11]**																	
Support management review process [**E13]**																	
Act on results of management review [**E13]**																	
Support pre-registration audit process, if registration is desired [**E13]**																	
Inform Coordination function of resources required to maintain the EMS **[M]**																	
Ensure the adequacy of all EMS documentation and procedures **[M]**																	
Ensure all EMS Documentation is reviewed and revised as required **[M]**																	
Ensure all key EMS activities are carried out **[M]**																	

Operational Support Activities	**Elapsed Time in Months**																
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**++**
Identify existing operational procedures **[O1]**								Implementation									Maintenance
Identify required operational procedures **[O2]**																	
Develop and document operational procedures **[O3]**																	
Provide feedback on EMS operational procedures to Core Team **[M]**																	

Administrative Support Activities	**Elapsed Time in Months**															
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**++**
Ensure existing EMS documentation is controlled **[A1]**																	
Ensure existing EMS records are managed **[A1]**																	
Ensure all EMS documentation is controlled **[A2]**																	
Ensure all EMS records are managed **[A2]**																	
Track EMS document review schedules **[M]**																	
Notify the EMS Core Team as documents near their review date [M]																	
Maintain EMS documentation and records **[M]**																	

Implementation

Maintenance

PRE-IMPLEMENTATION

Pre implementation activities occur in the preparatory stages of developing an EMS prior to wide- spread involvement of Center staff.

This chapter provides guidance on the activities that should be conducted in preparation for implementation and provides time lines for these activities. Because the Operational/Program Support Function and the Administrative Support Function do not occur during the pre-implementation phase no activities have been assigned to these two functions.

Duration and Timing Considerations

The pre-implementation planning and preparation process will require approximately three months. Recommendations on time periods provided in this chapter, or shown on the Implementation Flow Chart and Gantt are based on a three-month pre-implementation schedule.

Activities

Coordination Function [C1]

Pre-implementation activities of the Coordination Function include:

- The Center Director is responsible for designating the EMS Representative and assigning roles, responsibilities and authorities as defined in Chapter 4.1 of NPG 8553.1.

Case Study: At one firm the EMS Representative is also the Director of Environment, Health, and Safety. He has direct access to senior management and sits on several senior management committees. He typically delegates day-to-day activities to an EMS coordinator.

- Establish the Center EMS Core Team based on internal stakeholder group representation (e.g., programs, facility operations, and budget).

➢ *TIPS*: Select participants on the Center EMS Core Team with the existing management structure in mind and with environmental expertise as a secondary consideration. Remember that an EMS is a management system first and must therefore work with other management systems. Typical key tasks of the EMS Core Team include:

- Assessing initial status of existing EMS.
- Evaluating the EMS, and
- Developing and implementing necessary core EMS procedures.

Case Study: A large, international manufacturer decided to bring together a group of people from different departments and disciplines within the organization to form the EMS Core Team. Representatives from legal, production, risk management, environmental action, facility management, the resources group and distribution center management were used as an effective way to evaluate environmental exposures and to determine what the organization could do to optimize its environmental management system.

- Establish other EMS function groups (Coordination, Training/Awareness, Operational/Program, Administrative) to perform/oversee the following key tasks for each function:

  - Coordination.
    - Establish communication mechanisms.
    - Maintain communication.

  - Training/Awareness.
    - Develop training materials.
    - Conduct EMS related training.

  - Operational/Program.
    - Provide specific operational knowledge.

  - Administrative Support.
    - Implement EMS documentation control.
    - Implement EMS records management.

  - Ensure that lines of communication are in place:
    - Within the Core Team.
    - Between senior Center management and the core team, and
    - Between the core team and other key participants.

  - *TIPS*: Include communication mechanisms (e.g., periodic meetings, memos, and internal websites, etc).

- Identify key Center participants in the EMS.

  - *TIPS*: A key participant need not be a member of the Core Team, but his or her participation in the EMS is necessary for success.

- Identify and agree on targeted milestone dates for drafting EMS procedures and documentation.

Training/Awareness Function [T1]

Pre-implementation activities of the Training/Awareness Function include:

- Arrange for training the EMS Core Team members on ISO 14000/EMSPM as required.

  - *TIPS*: An initial team briefing on ISO 14000 and NPG 8553.1 is a good idea with added reinforcement over time.

- Schedule and initiate EMS awareness activities (may consist of computer assisted training, video, or class room training and other communication tools as appropriate per our discussion), or

- Revise existing environmental training to include EMS info.

  - *TIPS*: Awareness activities should communicate NASA's Environmental Policy and the EMS to Center staff. Awareness activities should occur as early as possible with assurances that roles and requirements will be communicated at appropriate times.

EMS Elements Execution Function [E1]

Pre-Implementation activities of the Execution Function include:

- Identify the scope of the Center EMS.

  - *TIPS*: The objective of this task is to identify activities over which NASA has control and influence and therefore should be included in the EMS. This task should be a priority, as it will require buy-in at the senior management level.

- Conduct a preliminary assessment to determine status of Center environmental management system with respect to the requirements of NPG 8553.1.

  - *TIPS*: This activity should be conducted as soon as possible and be completed at least one month before anticipated implementation kickoff.

- Develop a Center EMS Implementation Plan.

  - *TIPS*: The implementation plan should provide a list of actions that must be completed to meet the intent of each element of the EMS (as required by NPG 8553.1), individuals accountable for implementing these actions, and the timeframe for implementation.

Case Studies: A large electronic equipment manufacturer found that the scope of the initial EMS assessment is the key to the success of the assessment. It found that EMS is a tool, rather than a goal to be reached and therefore it should be used to improve and expand the scope of the initial assessment. Its focus was on the information that will be provided from the assessment so that it can be used to the best advantage within the company.

Another manufacturing company determined that a team approach to initial EMS assessment was more effective and accurate than a single input. When all management groups were involved, issues could be approached from several different perspectives. The cross-functional team consisted of upper management and staff, representatives from finance, fabrication engineering, product engineering, facilities, equipment maintenance, quality assurance, manufacturing, and sales.

IMPLEMENTATION

This chapter describes the activities to be carried out by each of the five functional support groups during the one-year EMS implementation. The sequence of implementation of an EMS is shown in the Implementation Flow Chart.

Additional activities required for registration of the EMS to ISO 140001 are described in a separate sub-section of the text, for those centers who wish to attain ISO registration.

Duration and Timing Considerations

Implementation and pre-implementation are not mutually exclusive events. Implementation consists of detailed work involving staff from various areas of the Center. It is not a discreet or sequential series of steps but rather consists of numerous activities that should proceed with considerable overlap and interaction as they develop. The Gantt charts provide an approximate timeframe for each activity/task.

- *TIPS*: A good rule of thumb is to spend 25% of the time/effort on planning elements, 50% on implementation elements and 25% on checking, corrective action and management review. The implementation elements involve all levels of the organization and thus require the highest degree of effort, cooperation and buy in.

Case Study: One large organization spent eight months concentrating on details associated with aspect and impact identification along with initial EMS procedure development without involving operational staff to ground the processes. The procedures were completely overhauled in order to reflect realistic application at the operating level. In addition, implementation was delayed by over six months and the final aspects listing bore little resemblance to the earlier lists.

Activities

Coordination Function [C2—C6]

- Coordinating communication between EMS Core Team and Center participants.
  - *TIPS*: Within the first three months, the Coordination Function should establish communication lines between the function groups and other EMS participants with mechanisms (e.g., internal website, e-mail, and meetings) to reach out to technical experts and resources across the Center to provide feedback.
- Coordinating the development of draft EMS procedures and documentation.
  - *TIPS*: Frequent follow-up on implementation status must take place between the Coordination Function and the Center EMS Core Team. The process of developing

draft procedures could take longer than expected, especially at larger Centers. Close monitoring will ensure that this process does not extend over a long period of time and impact remaining activities. In addition, the Coordination Function should be made aware of all potential problems (e.g., lack of human resources) to prevent delays in the schedule.

- Report to NASA HQ EMD on progress of EMS and metrics.

- Coordinate with NASA HQ EMD to schedule functional assessments and EMS audits.

- Conduct Center management review to assess:
  - Status, suitability and viability of the EMS, and
  - Objectives & Targets.

- Communicate results of management review to NASA HQ EMD.

Training/Awareness Function [T2—T4]

- Implement EMS awareness activities for all employees and ensure they are aware of:
  - NASA's environmental policy, and
  - EMS requirements as they apply to their position and responsibilities or,
  - Revise existing Environmental Training classes to include info on the EMS.

  ➢ *TIPS*: EMS awareness activities should start during pre-implementation with full rollout of awareness elements by months four and five.

Case Studies: At a large facility, all EMS awareness training is provided via computer based training (CBT). The training materials have been placed on the facility's main computer server. All employees log on and go through the training materials, which typically requires about one hour. The computerized training program tracks who has taken the training and each person's test scores, thus providing the necessary training records

Environmental awareness classes provided by one global company use multiple choice tests to help the instructor get an idea of staff's level of understanding and help the employees become more knowledgeable. This company also observed that as employees increase knowledge about the company and what it does to protect the environment, their sense of ownership grows.

- Conduct an EMS training needs assessment.

  ➢ *TIPS*: In order to conduct the training needs assessment, draft versions of management programs and operational controls must be developed to help identify staff that could have adverse impacts associated with high priority impacts to the environment.

- Arrange for job specific training (can be on-the-job training) to ensure that appropriate staff are aware of requirements defined in chapter 4.2.3 of NPG 8553.1.

- *TIPS*: Job specific training should be conducted on an on-going basis and be completed by month nine.

- Maintain records of EMS training.

Case Studies: Executives at one multi-site organization viewed training as integral to the implementation of their EMS. In addition to general awareness training, they provided detailed implementation training to thousands of staff members.

One large organization has prepared a comprehensive environmental training manual. This manual identifies all the environmental training (awareness and job-specific) required by employees within each level and function. The manual provides a complete listing of all courses available in house as well as guidance on how to select outside vendors. The company also has put in place materials for all in-house training.

EMS Elements Execution Function [E2-E13]

- Identify the activities, products and services within the scope of the EMS (see Step 1 List Activities, Products and Services Chapter 3.1 of EMSPM).

- Develop a Center procedure for identifying legal and other requirements (i.e., state, local, permit driven legal requirements, and NASA-wide agreements).

- Determine if Risk Matrix example 1 or 2 best suites the Centers operations

  - *TIPS*: Example 1 is advisable to use when the Center manages environmental issues directly with it's environmental office and there are individual programs for a number of the aspects listed under Step 4 of Chapter 3.1 of NPG 8553.1.

  - *TIPS*: Example 2 is advisable for use at a larger Center for those area where large performance based contracts are used and civil service personnel set contract requirements and monitor contractor performance and do not direct the contractors. If this method is used, for some areas of the Center there may be a need to consider if for selected areas of the Scope of the Center's EMS if Example 1 is appropriate. This is acceptable.

- Identify environmental aspects and impacts in accordance with Chapter 3.1 of NPG 8553.1.

  - *TIPS*: To ensure that the list of environmental aspects and priority impacts is accurate and comprehensive, key operational Center staff should have input into the process. The list of aspects and impacts will evolve throughout implementation.

- Apply the risk procedure (see Steps 6,7, 8, and 9 of Chapter 3.1 of the NPG 8553.1) and completing the Risk Matrix Form in Appendix A of the NPG 8553.1.

- Establish documented objectives and targets for high priority impacts.

Case Studies: Environmental staff and legal counsel at one organization jointly prepared one-page overviews of new legal and other requirements. This ensured common understanding and application of these requirements across the organization.

A large organization centralized the tracking and management of federal and state legal requirements but required individual facilities to manage local and municipal requirements.

Case Studies: A medium-sized company used a cross-functional team appointed by top management to determine the company's environmental aspects. The team used a brainstorming session to list all of the company's inputs, outputs and conversions of materials. The team also examined the company's purchases, processes and waste streams, and interviewed and incorporated input from external stakeholders, such as neighbors, suppliers and customers.

A large organization developed a common database that consolidates environmental aspects for all of its facilities. Each facility selected applicable aspects from the common database and generated a customized database addressing its own specific operations.

Examples: Objective: Reduce the amount of solid non-hazardous waste sent to landfill.

Target one: Recycle or re-use 90% of all used paper.

Target two: Compost 50% of all organic material generated.

- Establish documented environmental management programs to achieve environmental objectives and targets.

- Develop procedures for (if required based on preliminary review):
  - Determining EMS training needs, and
  - EMS document control.

  - *TIPS*: The procedure for determining training needs must be developed early to allow the Training/Awareness Function to complete the identification of training requirements associated with high priority impacts. In addition, the EMS document control procedure also is a key procedure to start early as all other EMS related documents need to conform with document control requirements.

- Ensure adequacy of existing procedures for:
  - Non-conformances (current ISO 9001 procedure or other Center procedure).
  - Retention of EMS records and of compliance records.
  - Internal and external communications, and
  - Receiving, recording and responding to external communications.

- *TIPS*: Many of these procedures already exist at NASA and should be used in the EMS. However, they were not developed with EMS in mind and may need to be revised to meet the requirements of the EMSPM.

- Document EMS roles, responsibilities and authorities.

  - *TIPS*: Every level of a Center will have roles and responsibilities related to the EMS including:
    - Providing resources to ensure conformance with the EMS, and
    - Ensuring that EMS requirements are established, implemented and maintained in accordance with NPG 8553.1.

- Ensure EMS documentation and procedures are developed where required to meet the requirements of NPG 8553.1.

  - *TIPS*: Refer to the Center-specific implementation schedule (resulting from the preliminary assessment) to ensure the timely completion of required procedures. Closely monitoring the review of draft procedures will help to avoid multiple review loops. Allocate a reasonable but fixed period of time for review by each individual and follow-up frequently.

Case Study: At one large North American utility, the EMS Representative ensured that reviewers of draft EMS documents initially were provided with a specified timeframe for completion of their reviews. Progress was tracked regularly and all comments were received by the due date.

- Review and obtain approval of the following:
  - EMS roles, responsibilities and authorities.
  - Finalized risk matrix form.
  - Objectives and targets.
  - Environmental management programs, and
  - EMS procedures.

    - *TIPS*: It is imperative to close the approval loop before the above EMS elements are communicated and implemented. The review process will ensure that the procedures are accurate and functional. Approval will establish "ownership" and foster buy-in at all levels of the Center.

- Ensure implementation of all EMS procedures.

  - *TIPS*: Monitoring ongoing conformance at the operational level is a good practice to measure the effectiveness of the procedures.

- Support functional assessment and internal EMS audit.

  - *TIPS*: Periodically communicate with the Coordination Function the EMS implementation status and readiness for the internal audit process.

- Address non-conformances.

  - *TIPS*: Based on the results of the functional assessment process, develop a plan to address non-conformances. Accountability should be assigned to monitor completion of action items.

- Support management review process.

- Act on results of management review.

  - *TIPS*: Obtain results from the management review to address opportunities for improvement that were generated by this process.

Operational/Program Support Function [O1-O3]

- Identify existing procedures and documentation associated with high priority impacts including:
  - Operational controls.
  - Manuals, and
  - Environmental records.

- Identify procedures that must be developed.

  - *TIPS*: Procedures are required for every high priority impact identified through the risk assessment process:
    - To cover situations where their absence could lead to deviations from the environmental policy, Objectives and Targets, and
    - To monitor and measure the key characteristics of operations.

- Develop and document procedures as required for operational controls and monitoring and measurement.

  - *TIPS*: Operational procedures should be clear and to the point. In most cases, the content of the procedure is what the operators do currently.

Administrative Support Function [A1-A2]

- Initiate document control procedure.

- Apply the document control and records management procedures to ensure all EMS documentation is controlled and records are managed.

- *TIPS*: Document control and record management is a common source of EMS non-conformance. Regular checks should be carried out through sampling key EMS documents.

Additional Activities Required For Registration (Optional)

Coordination Function [C2]

The Coordination Function must:

- Participate with NASA HQ EMD in choosing a Registrar and communicating with the Registrar.

  - *TIPS*: It is important to have open lines of communication with a Registrar early in the implementation process in order to develop a relationship and obtain a better understanding of their interpretation of the ISO 14001 Standard.

- Work with NASA HQ EMD to schedule a Registrar to conduct document review, pre-registration audit and, if desired, a registration audit.

EMS Elements Execution Function [E 11]

The Center EMS Elements Execution Function must:

- Support the pre-registration audit process.

  - *TIPS*: Through the Coordination Function, maintain good communication channels with the Registrar to ensure the pre-registration audit process will be conducted effectively.

MAINTENANCE OF THE EMS

An EMS must be maintained in light of changing organizational circumstances and NASA's overall commitment to continual improvement. This section describes key EMS maintenance activities.

Note: Once implementation is completed, the role of the function groups can be maintained, but at a reduced level of effort. It is important that the day-to-day EMS activities become part of how NASA does business.

Duration and Timing Considerations

Maintenance activities are prescribed on an on-going basis, as operational circumstances change and warrant maintenance, as a result of a pre-established process such as an audit, a management review, or the review of an EMS document.

Activities

Coordination Function

- Ensure the internal audit and management reviews are conducted as planned, and that corrective actions are implemented.

- Ensure the appropriate resources are allocated to support the EMS.

Training/Awareness Function

- Develop a list of training requirements on an annual basis.

  - *TIPS*: To allow for proper planning, managers at the operational level should obtain a list of requirements and schedule employees to be trained as early in the planning cycle as possible.

- Ensure the continuing adequacy of EMS training.

  - *TIPS*: Training should be offered frequently to account for new employees (EMS awareness activities), transfer of employees between department, and hiring of new contractors.

- Maintain training materials.

- Maintain EMS training records.

EMS Elements Execution Function

- Ensure the continuing adequacy of EMS procedures.

- Ensure that reviews of all EMS documents are carried out according to their pre-established schedule.

    - *TIPS*: Examples of EMS documents that must be reviewed periodically include:
        - Risk matrix form.
        - Documented EMS procedures, and
        - Environmental management programs.

- Ensure that all key activities that are scheduled as part of the operation of the EMS are carried out as planned.

    - *TIPS*: Examples of such activities include:
        - Functional audits.
        - Report on EMS performance, and
        - Annual review of the emergency preparedness and response plan.

Operational/Program Support Function

- Provide feedback to the EMS Core Team on the on-going effectiveness of operational controls.

Administrative Support Function

- Track EMS document review schedules and notify the EMS Elements Execution Function of nonconformances accordingly.

- Maintain EMS records.

Additional Activities Required To Maintain Registration (Optional)

Coordination Function
The Coordination Function is accountable for:
- Maintaining communication with the Registrar and scheduling EMS surveillance audits.

EMS Elements Execution Function
The Center EMS Core Team is accountable for:
- Monitoring and ensuring the EMS readiness for surveillance audits.

Appendix A
EMS Checklist

September 2002

NASA EMS Checklist- Coordination Function

Activity Code	Activity	Person in Charge of Activity	Date of Completion
C1	***Designate EMS representative***	Center Director	
	Establish EMS Core Team (and support teams, as appropriate)	Center Director and EMS Representative	
	Identify key Center participants		
	Define lines of communication		
	Identify milestone dates		
C2	Coordinate communication between Core Team and Center participants		
	Participate with NASA HQ in choosing a registrar (optional)		
	Initiate communication with the designated registrar (optional)		
C3	Coordinate development of draft EMS procedures and documentation		
	Report to NASA HQ on EMS progress and metrics		
C4	Work with NASA HQ to schedule registrar for document review, pre-registration audit and possible future registration audit (optional)		
C5	Coordinate with NASA HQ to schedule functional assessments and EMS audits		
C6	Conduct Center management review		
	Communicate results of management review to NASA HQ		

NASA EMS Checklist- Training/Awareness Function

Activity Code	Activity	Person in Charge of Activity	Date of Completion
T1	***Train EMS Core Team members***		
	(8 hour basic training)		
	Schedule and initiate EMS awareness activities, or Revise existing environmental training classes to add EMS info		
T2	***Conduct EMS awareness activities***		
	(e.g., 0.5 hour basic computer course, video or training class)		
T3	Conduct EMS training needs assessment		
T4	Conduct job-specific EMS training		
	Maintains records of EMS training		

Appendix B
Implementation Template

September 2002

Center Name _____

Pre-Implementation

1. EMS Center Representative (C1): _____.

2. Members of the EMS Core team (C1):

Name	*Code*	*Phone*	*E-mail*

3. Establish EMS support team functions, as needed (C1):

Coordination Team (communication)
Function Team Leader: _____.

Name	*Code*	*Phone Number*	*E-mail*

Training Team
Function Team Leader: _____.

Name	*Code*	*Phone Number*	*E-mail*

EMS Elements Execution Team
Function Team Leader: _____.

Name	*Code*	*Phone Number*	*E-mail*

Operational Program Support Team
Function Team Leader: _____.

Name	*Code*	*Phone Number*	*E-mail*

Administrative Support Team
Function Team Leader: _____.

Name	*Code*	*Phone Number*	*E-mail*

4. Key participants in the EMS (C1):

Name/Office	*Code*	*Phone*	*E-mail*

5. Core Team should conduct a preliminary assessment to determine status of their Center with respect to the requirements of the EMS Procedures Manual (E1). Preliminary assessment conducted on _____.
(date)

6. EMS Core Team communication (C1):
Regularly scheduled meetings on _____in _____.
(date and time) (location)

7. Milestone Dates for the EMS (C1):

Milestone	*Start Date*	*Completion Date*
Identify Scope of Center EMS		
Identify Activities, Products, and Services		
Determine Aspects and High Priority Impacts		
Establish Objectives and Targets		
Establish Documented Environmental Management Programs		
Identify Existing Procedures Applicable to the EMS		
Develop Draft Procedures for EMS (if existing procedures are not applicable)		
Finalize Procedures		
Implement Procedures		
Schedule Functional Assessment/ EMS Audit		
Management Review		
ISO 14001 Registration (optional)		
Select Registrar in Conjunction with NASA HQ (optional)		
Pre-Registration Audit (optional)		

8. EMS Core Team Members Training Schedule (T1):

Name	*Type of Training*	*Date completed*

9.Center-wide EMS Awareness Activities, will be conducted on (T2):
Activity: _____ Date:_____.
Activity: _____ Date:_____.

9. Procure EMS Support Contractors (as necessary) (E1):

Name of Contractor/Project Manager	*Date Hired*

Implementation

1. Establish a mechanism for communication between EMS Core Team and Center participants (e.g., website) (C2).
Method of communication: _____.

2. List Center Activities, Products, and Services (E2):

Activities	*Products*	Services

3. Develop Center procedure for identifying Legal and Other requirements (E2):
_____.
(date completed)

4. Identify Aspects (E2): _____ and _____.
(date initiated) (date completed)

5. Apply Risk Procedure (from risk matrix form) to determine High Priority Impacts (E3): _____ and _____.
(date initiated) (date completed)

6. **Establish Objectives and Targets (E3): _____ and _____.**
   (date initiated) **(date completed)**

7. **Identify existing operational procedures (and documentation) associated with High Priority Impacts (O1):**

High Priority Impact	*Existing Procedures*

8. **Identify what operational controls, and monitoring and measurement procedures are required for High Priority Impacts (O2):**

High Priority Impact	*Operational Control*	*Monitoring/Measuring Procedure*

9. **Document Environmental Management Programs (E4): _____ _____.**
   (date initiated) **(date completed)**

10. **Draft or use existing procedures for determining EMS training needs (E5): _____.**
    (date completed)

11. Evaluate adequacy of existing procedures (E6):

Existing Procedure	*Initial Assessment- Adequate yes/no*	*Person Responsible for Revision*
Document Control		
Records Management		
Emergency Management		
Internal Communication		
External Communication		
Training Needs		
Non-conformance and Corrective Action		
Operational Controls		
Monitoring and Measuring		

12. Draft necessary EMS Procedures (E5): _____and _____ .
(date initiated) (date completed)

13. Apply Document Control procedures to existing EMS documentation (A1):

EMS Documentation	*Person Responsible for Document Control Procedures*	*Date Applied*

14. Apply Records Control procedures to existing EMS Records (A1):

EMS Records	*Person Responsible for Records Control Procedures*	*Date Applied*

15. Document EMS Roles, Responsibilities and Authorities (E7): _____ and _____.
(date initiated)
(date completed)

16. Develop Calibration and Maintenance Procedures to ensure equipment is properly maintained and calibrated (O3):

Equipment Needing Calibration	***Frequency***

17. Final EMS procedures reviewed on (E9): _____and
(date)
approved by _____.
(approving authority)

18. Ensure implementation of all EMS procedures (90 days) (E10):
_____and _____.
(date initiated) (date completed)

19. Report to NASA HQ on EMS progress (C3):_____.
(dates)

20. Conduct job-specific training needs assessment (T3): _____.
(date completed)

21. Conduct job-specific EMS training (as necessary)(T4):

Person Needing Training	***Person Conducting Training***	***Date of Training***

22. Support Functional Assessment/ EMS Audit on (E11): _____.
(date)

23. Results of Functional Assessment/EMS Audit (E11):

Date of Functional Assessment/ EMS Audit	*Non-conformance Items*	*Person Responsible for Correcting Non-conformance*

24. Conduct Management Review (C6):_____.
(date)

25. Results of Management Review communicated to NASA HQ on (C6):
_____.
(date)

ISO 14001 Registration Activities (Optional)

1. Coordinate with NASA HQ to select a Registrar (C2):

Registrar	*Contact Information*

2. Contact NASA HQ to schedule Registrar for Document Review and Pre-registration Audit (C4): _____ on _____.
(person initiating contact) (date)

3. Support pre-registration audit (E13): _____.
(date)

4. Determine corrective action (if necessary):

Non-conformance	*Person Responsible for Corrective Action*	*Date Completed*

5. Schedule registration audit: _____.
(date)

NASA EMS Checklist- Execution Function

Activity Code	Activity	Person in Charge of Activity	Date of Completion
E1	***Identify what is included in the EMS (scope)***		
	Conduct the gap analysis		
	Develop EMS implementation plan		
E2	Identify activities, products, and services		
	Develop procedures for legal and other requirements		
	Identify aspects and impacts		
E3	Apply risk procedures		
	Establish objectives and targets		
E4	Establish documented environmental programs to achieve objectives and targets		
E5	Develop procedures for determining EMS training needs		
	Develop procedures for document control		
E6	Ensure adequacy of existing non-conformance procedures		
	Ensure adequacy of existing records retention procedures		
	Ensure adequacy of internal communication procedures		
	Ensure adequacy of external communication procedures		
E7	Document EMS roles, responsibilities and authorities		

Activity Code	Activity	Person in Charge of Activity	Date of Completion
E8	Ensure EMS documentation and procedures are developed		
E9	Review and obtain approval for EMS roles, responsibilities, and authorities		
	Review and obtain approval for finalized risk matrix Form		
	Review and obtain approval for objectives and targets		
	Review and obtain approval for environmental management programs		
	Review and obtain approval for EMS procedures		
E10	Ensure implementation of all EMS procedures		
E11	Support functional assessment and internal EMS audit		
	Address non-conformances		
E12	Support management review process		
E13	Act on results of management review		
	Support pre-registration audit process (Optional)		

NASA EMS Checklist- Operational/Program Support Function

Activity Code	Activity	Person in Charge of Activity	Date of Completion
O1	***Identify existing procedures associated with high priority impacts***		
O2	Based on high priority impacts, identify which Operational Control procedures are required		
	Identify which monitoring and measurement procedures are required		
03	Develop and document procedures (if required) for operational control and monitoring and measurement		

NASA EMS Checklist- Administrative Support Function

Activity Code	Activity	Person in Charge of Activity	Date of Completion
A1	***Apply document control procedures to exiting EMS documentation***		
	Apply records procedures to manage existing EMS records		
A2	Confirm EMS documentation is controlled according to the document control procedure		
	Confirm EMS records are managed according to procedures		

Appendix C
Glenn Research Center
EMS Implementation Plan

September 2002

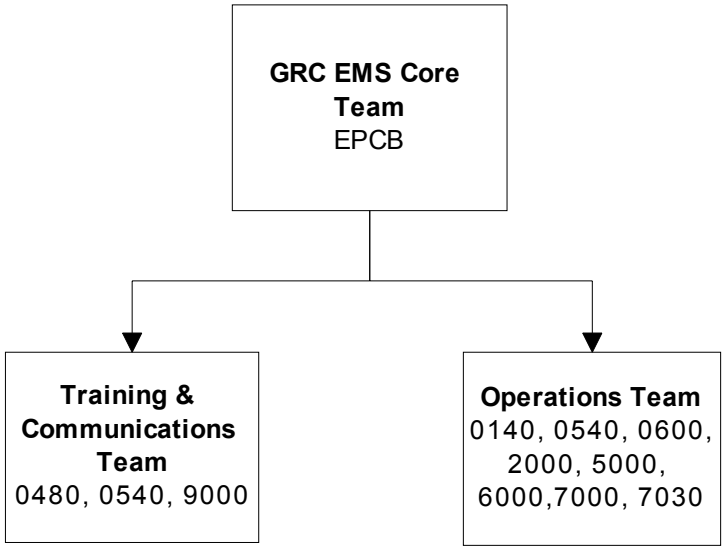
Environmental Management System Implementation Planning
for John H. Glenn Research Center
Approved by the Environmental Pollution Control Board
May 10, 2000

This GRC EMS Implementation Plan is designed as a road map for the pilot implementation of NASA NPG 85XX, *NASA Environmental Management System (EMS) Procedures Manual*, at John H. Glenn Research Center Lewis Field and Plum Brook Station. This Plan is consistent with the guidance provided in the April 7, 2000 *NASA Centers EMS Implementation Guide*, modified to best meet GRC's organizational structure and operating procedures.

Organization

The Chief, Environmental Management Office (EMO), is the GRC EMS Representative and will provide leadership, day-to-day management and support for the EMS effort. The Chief, EMO will be the NPG 85XX EMS champion responsible for obtaining and retaining Management commitment, preparing the EMS Implementation budget and schedule, and building the project team.

Top management support and oversight of the EMS implementation at GRC is provided by the Center's Environmental Pollution Control Board (EPCB). Two additional teams, Training & Communications Team and an Operations Team, will be established under the EPCB to provide stakeholder and customer input and to support EMS implementation. An organizational chart of the Core Team structure is provided below.



Contractor implementation support is provided through a task under the SAIC environmental support services contract. Additional support will be provided, as needed, by EMO staff and other Center organizations.

Responsibilities

EMS Representative (Michael Blotzer): Provides leadership and coordination of EMS activities, coordinates contractor and EMO support, modifies existing and develops new BMS procedures, reports to the EPCB. Serves as the GRC representative to the NASA-wide EMS Core Team.

GRC Core Team (EPCB): provides top-management support and oversight. Reviews and approves EMS activities.

Operations Team: Leads the environmental planning process, including identifying products and services and their associated environmental aspects, impacts and risks; and developing environmental goals, objectives, and metrics. Reviews BMS documents. It is estimated that membership on this team will require a commitment of about 40 hours.

Communications & Training Team: Identifies and coordinates training, communication, and outreach activities. Reviews BMS documents. It is estimated that membership on this team will require a commitment of about 40 hours.

Contractor Support: Provides technical and administrative support for the modification of existing and development of new BMS procedures, development and delivery of training, environmental planning and risk assessment, and other support necessary to ensure success.

Communication

The EMS implementation and procedures will be communicated to GRC stakeholders and customers through strategies that cut across organizational levels in accordance with a new BMS Internal and External Communications procedure. The EPCB, will be briefed regularly on the EMS during regularly scheduled quarterly and with special meetings, as needed. The Director's Leadership Team will be briefed early in EMS development and on the results of the ISO-14000 pre-registration audit. The EMS will be publicized through newsletters, closed-circuit television bulletin board, flyers, and other promotional activities. In addition, all staff will receive basic training in the EMS and their responsibilities.

Training

All employees will receive basic training in the EMS and their responsibilities. In addition, the Core Team, Communications and Training Team, Operations Team, and EMO staff will receive additional training to enable them to fulfill their roles during implementation. Finally, in the later stages of the EMS implementation employees involved with priority operations (e.g., waste management) will be identified and receive additional operational training.

The time allotted for the various training elements is:

- Core Team, 1.5 hours, will cover EMS Awareness including Environmental Policy (commitment to P2, regulatory compliance, environmental restoration and conservation and continual improvement), Planning (Environmental Aspects/Impacts and Targets and Objectives), Implementation, Preventative and Corrective Actions and Management Review.

- Subteams, 4 hours – The course will cover the same material covered in the Core Team training, but with more in-depth coverage of specific implementation procedures to assure effective implementation.
- EMO Staff, 4 hours – The course will cover the same material as the Core Team training but with more in-depth coverage of all BMS procedures to allow complete integration of employees in EMS implementation and to assure competency in all EMS procedures and documentation.
- Basic Training, 1 hour – Training material will cover the contents of the EMS manual including showing the EMS as driven by GRC's environmental impacts, integrating environmental management activities with GRC's business functions and BMS, and an avenue for continually improving environmental performance.
- Operational Training, as required - Hours and course content will be in accordance with the complexity of the activities of each directorate and their relative contribution to Center's environmental impacts.

GRC Implementation Plan Elements and Milestones

Key implementation elements and milestones are listed in the table below. This list is intended as a top-level view of the implementation process. While the table does not contain all the elements contained in the implementation checklists in the NASA Center EMS Implementation Guide, all applicable elements will be addressed to ensure that GRC is prepared for the ISO 14000 pre-registration audit in 2001

Element	**Date Due or Completed**
Designate EMS Representative	2/00
Establish Core Team	2/00
EMS Gap Analysis	3/00
Develop training materials and conduct EMS training: Train EMO Staff	5/00
Train Core Team	5/00
Develop Implementation Plan	5/00
EPCB EMS Training, briefing on Gap Analysis, review and approval of GRC Implementation Plan	5/10/00
Update BMS procedures	5/00
Start to Implement BMS procedures	6/00 – 9/00
Train Operations & Communications Teams	6/00
Apply Environmental Planning procedures to GRC	6/00 – 9/00
EPCB approval of environmental planning	9/00
Establish Objectives, Targets, Metrics, and Operational Controls	9/00 – 11/00
EPCB approval of Objectives, Targets, Metrics and Operational Controls	11/00

Develop Employee Awareness Activities	6/00
Deliver Employee Awareness Activities	7/00 – 10/00
EMS Training Needs Assessment	8/00 – 10/00
Job Specific EMS Training	10/00 – 12/00
Management Review (Monthly Quality Reviews, Quarterly and special EPCB Meetings)	5/00 –
Pre-Audit Self Assessment	12/00 or 1/01
Pre-Registration Audit	2/01 or 3/01

Appendix D
Johnson Space Center
EMS Implementation Plan

DRAFT

Environmental Management System

(EMS) Implementation Plan

NASA
Lyndon B. Johnson Space Center
Houston, Texas

Responsible Office:
JA/Center Operations Division

Version 5: July 12, 2001

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continued

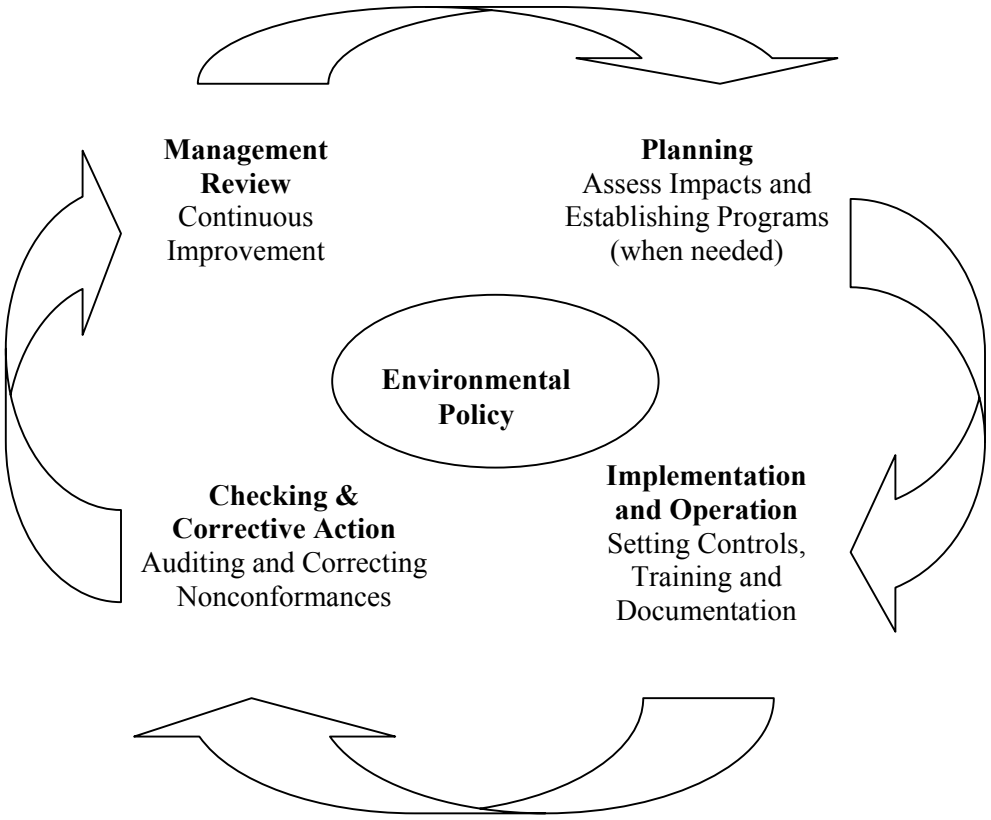
Appendices

SECTION 1

Introduction

1.1 What is an Environmental Management System?

An Environmental Management System (EMS) is a management tool for achieving and demonstrating environmental performance according to your environmental policy. It establishes a framework for assessing impacts to the environment; establishing programs for problem areas; implementing training, procedures, and documentation; performing audits and corrective action, and continuous improvement through management review.



The Johnson Space Center (JSC) EMS will incorporate the following:

- the Environmental Protection Agency's (EPA's) Comprehensive Environmental Management Program (CEMP);
- the International Organization for Standardization (ISO) procedures in the ISO 14001 Standard for establishing an EMS;
- the NASA Headquarters Draft EMS Procedures Manual; and
- the Executive Order, which requires federal agencies to implement an EMS by 2005.

1.2 What are the benefits of an EMS?

There are four major benefits for JSC.

1. ***Increases Compliance and Reduces Liability:***

   An EMS includes a proactive environmental compliance program, as opposed to a reactionary scenario. For JSC, this means identifying the potential for releases before an incident occurs, such as the nitrogen tetroxide release, the release of tetrachloroethylene and freon into the groundwater, and discharges of contaminated wastewater to storm water sewers. This also means ensuring that the on-site contractors are also accountable for environmental compliance. In addition, facilities with an EMS can receive enforcement discretion from regulatory agencies resulting in reduced fines and penalties.

2. ***Conserves Resources and Reduces Costs:***

   At the same time the government has reduced financial and human resources, there is an increase in environmental regulations and demands on the environmental staff. By implementing an EMS, JSC can manage the process of compliance in a more efficient and less costly manner by educating all Center personnel and developing a proactive system of preventing environmental incidents, which are time-consuming and costly.

3. ***Improves Public Image:***

   Implementing an EMS and increasing environmental compliance will improve JSC's public image. For JSC, this means the possibility of more funding, which is dependent on public image and policy. This also means improved relations with regulatory agencies, which can result in fewer inspections and fewer notices of non-compliance.

4. ***Protects the Earth:***

   Implementing an EMS it is the right thing to do. For JSC, this means reducing and preventing pollution, conserving resources, and protecting the environment.

White Sands Test Facility implemented an EMS and was registered under ISO 14001 in April 2000. White Sands has already experienced benefits, including increased facility-wide awareness of environmental issues and identification of several significant environmental impacts that are currently being address to reduce liabilities and costs.

What are the objectives of an EMS?

Johnson Space Center (JSC) volunteered, as one of three NASA facilities, to take an active role in evaluating and developing an agency-wide EMS program. The objectives of implementing this EMS at JSC include:

- to actively involve Senior Management in the environmental management program;
- to ensure that the current environmental impacts at JSC are identified and controlled and that future environmental impacts are evaluated during the planning process;
- to improve consistency in the environmental program and increase accessibility of environmental procedures and information throughout JSC;
- to increase awareness and integrate environmental accountability into everyday decision making similar to JSC's quality, safety, and health programs;
- to promote continual improvement by periodically evaluating JSC's environmental performance.

"Our Mission is Space,
Our Responsibility is the Earth."

1.4 What factors are considered in this EMS?

The following site-specific factors have been considered in developing this Implementation Plan:

- the ISO 9001 Quality Management System program;
- the VPP Star Health and Safety program;
- the Executive Safety Committee (ESC);
- the Quality System Management Review (QSMR);
- the Quality Systems Panel (QSP);
- the Environmental Stewardship Subcommittee (ESS);
- the JSC Directorates and their activities structure;
- the NASA missions and programs;
- the JSC physical plant, facilities, and buildings and grounds
- the JSC Facilities Manager organization;
- the activities and attitudes of the NASA employees and contractors;
- the JSC Contractor activities and existing contractual provisions;
- the directives and other requirements to which JSC subscribes; and
- the federal, state, and local laws and regulations.

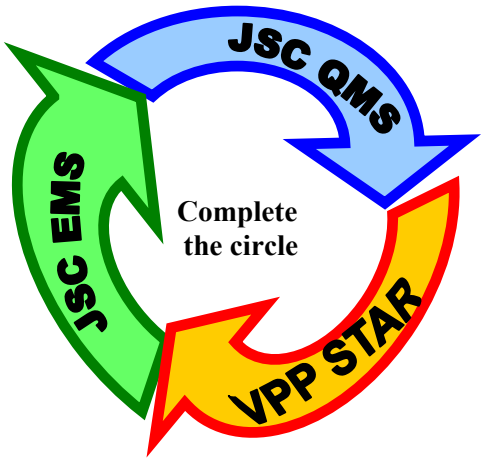
Input was also obtained from White Sands Test Facility and two other NASA facilities that are also in the process of implementing an EMS.

1.5 What is the strategy for implementing this EMS?

This plan describes the overall strategy for implementing an EMS at JSC. This strategy includes:

- utilizing the existing JSC systems and programs, especially the Quality System and the VPP program, to achieve the objectives of the EMS in the most cost-effective and efficient manner;
- avoiding drastic changes during the implementation and let the system work to affect changes over time;
- minimizing the impact on organizations by using the Environmental Office expertise to develop environmental procedures and common work instructions and facilitate the assessment of environmental impacts;
- using JSC's existing programs for training personnel; and
- using all available means of communicating the benefits of an EMS.

The framework for the majority of the EMS elements are already established in JSC's Quality System, and Health and Safety program and there is already a culture established for quality and safety and health. Many of the most time-consuming and difficult elements, such as document control, are already in place at JSC. Implementing an EMS will complete the circle of excellence at JSC.



1.6 What does this EMS include?

The scope of this EMS includes Johnson Space Center, Ellington Field, and Sonny Carter Training Facility. The White Sands Test Facility is not included in the scope of this EMS since White Sands has independently implemented an EMS and obtained ISO 14001 Registration.

All JSC organizations, including on-site contractors, will be required to comply with this EMS. Where there are legitimate contractual impediments to contractor implementation, decisions on how to include those activities will be handled on a case-by-case basis. The specific elements and responsibilities for implementing the EMS elements are discussed in Sections 2 and 3, respectively.

At this time, off-site contractors ***will not be*** included in the scope of this EMS. Contracting provisions will be reviewed to ensure that the required environmental compliance provisions are included in contracts.

The scope of this EMS will be reviewed by a Registrar prior to full implementation. The scope of this EMS includes internal audits, in preparation for a registration audit. This will enable JSC to submit for registration under ISO 14001 at the conclusion of the EMS implementation in July 2001. Registration will establish JSC as a Center for environmental excellence and will further enhance JSC's image with employees, the regulatory community, and the public at large.

SECTION 2

Elements of an EMS

2.1 General

An EMS is defined as a system that incorporates people, procedures, resources, responsibilities, and work practices, in a formal structure to implement, achieve, and maintain the environmental policy. The JSC EMS will incorporate the same 17 elements included in the ISO 14001 Standard, and will also include metrics. The table below describes these elements and includes the ISO element number in parentheses. Many of these elements are similar to the elements in the ISO 9000 Quality Standards. Definitions of standard terms are included in Appendix A.

2.2 Environmental Policy

EMS Element	Description of EMS Element
(2) Policy	Requires an Environmental Management Policy and requires Senior Management commitment to ensure that it is implemented, maintained, and communicated to all employees, and available to the public. JSC has an Environmental Policy (included in Appendix B). The policy is the driving force behind improving environmental performance. The existing policy will be modified to incorporate JSC's EMS and the EMS Management Structure.

2.3 Planning (Assessing Impacts and Establishing Programs)

EMS Element	Description of EMS Element
(3.1) Environmental Aspects and Impacts	Requires all JSC organizations to identify the environmental aspects of their activities, products, and services under normal, abnormal, or emergency conditions. These aspects are then assessed to determine if there could be a significant, or "Priority", impact to the environment (such as a release or regulatory noncompliance). This is the initial focal point in building a proactive EMS. This process of aspect and impact assessment will be facilitated by the Environmental Office, but will require commitment of human resources from JSC's organizations as discussed in Section 4.
(3.2) Legal and Other Requirements	Requires identifying the laws and other requirements as they apply to the environmental aspects of JSC's activities, products, and services. JSC's Environmental Office will develop a summary of legal and other requirements to assist with assessing the environmental impacts at JSC.

EMS Element	Description of EMS Element
(3.3) Objectives and Targets	Requires JSC to set specific objectives and targets for each Priority Impact and, as deemed necessary, to control, reduce or eliminate negative impacts or increase positive impacts. The organization managers will establish objectives and targets for each Priority Impact unique to their organization. The EMS Representative will be responsible for recommending objectives and targets for Center-wide impacts and to achieve regulatory compliance.
(3.4) Programs	Requires organization management to establish environmental programs to achieve the objectives and targets. The programs include the means and time frame for achieving the management goals. Programs are the mechanism for making changes and improving environmental performance. EMPs will be developed by the organizations for impacts that are unique to an organization. The Environmental Office and the EMS Representative will identify the need for Center-wide EMPs.

2.4 Implementation and Operation (Setting Controls, Training, Documentation)

EMS Element	Description of EMS Element
(4.1) Structure and Responsibility	Requires Senior Management to establish the structure of the EMS, including roles, authority, responsibility, and interrelationships. Requires Senior Management to name an EMS Representative and provide necessary resources. The structure and responsibilities for implementing the EMS are discussed in Section 3. The structure and responsibilities for maintaining the EMS will be determined after implementation is completed.
(4.2) Training, Awareness and Competence	Requires identifying the environmental training needs and conducting training to ensure that people performing work that can impact the environment are competent. The EMS Representative must develop an awareness training program for all employees. Specific training will be required for personnel working in areas where their personal performance can impact the environment.
(4.3) Communication	Requires defining the procedure for internal communication, and external communication, particularly for issues related to Impacts. JSC has procedures for reporting to regulatory agencies. The EMS Representative will develop procedures for communicating the EMS in coordination with the VPP Health and Safety and the ISO 9000 Office and will develop procedures for external communication in coordination with the Public Affairs Office.

EMS Element	Description of EMS Element
(4.4) Documentation	Requires establishing and maintaining a system to describe the EMS program and provide direction to related documentation. The EMS Representative will establish a system to document the EMS, utilizing the Quality System framework. JSC's Environmental Office will develop the general environmental procedures that will be required during the implementation of the EMS.
(4.5) Document Control	Requires document control similar to the ISO 9000 requirements. The EMS will utilize the document control procedures established under the JSC Quality System.
(4.6) Operational Control	Requires developing procedures with operational criteria to ensure that operations associated with Priority Impacts are carried out under controlled conditions. Requires appropriate environmental controls for contractors. JSC organization personnel will be required to develop procedures to control operations if a procedure is necessary to achieve the objectives and targets.
(4.7) Emergency Preparedness and Response	Requires an emergency plan, including response procedures (fire, weather) that protect the environment. The EMS Representative will review the existing JSC emergency preparedness and response plan to ensure that environmental protection during response actions is included.

2.5 Checking and Corrective Action (Auditing & Correcting Nonconformances)

EMS Element	Description of EMS Element
(5.1) Monitoring and Measurement	Requires evaluating performance in meeting objectives and targets, and complying with operational procedures, including instrument calibration and maintenance. Also, requires measuring or monitoring compliance with the laws and other requirements. The existing procedures under JSC's Quality System will be utilized.
(5.2) Nonconformance and Corrective and Preventive Action	Requires identifying environmental nonconformances and mitigating the impact on the environment and implementing corrective or preventive actions to prevent reoccurrence. Existing procedures under the Quality System and VPP Safety and Health program will be utilized and modified as necessary to meet this requirement.
(5.3) Records	Requires record keeping including training, audits, and reviews. The existing Quality System procedures will be utilized for records. The EMS Representative will coordinate with Human Resources on training records.

EMS Element	Description of EMS Element
(5.4) EMS Audit	Requires audits of the EMS elements and performance related to environmental compliance. The EMS Representative will coordinate with Human Resources to provide training for internal EMS auditors during the implementation and will coordinate with the ISO 9000 Office to coordinate cross-training for internal Quality System auditors. NASA Headquarters will be responsible for conducting functional audits every three years.

2.6 Management Review (Continuous Improvement)

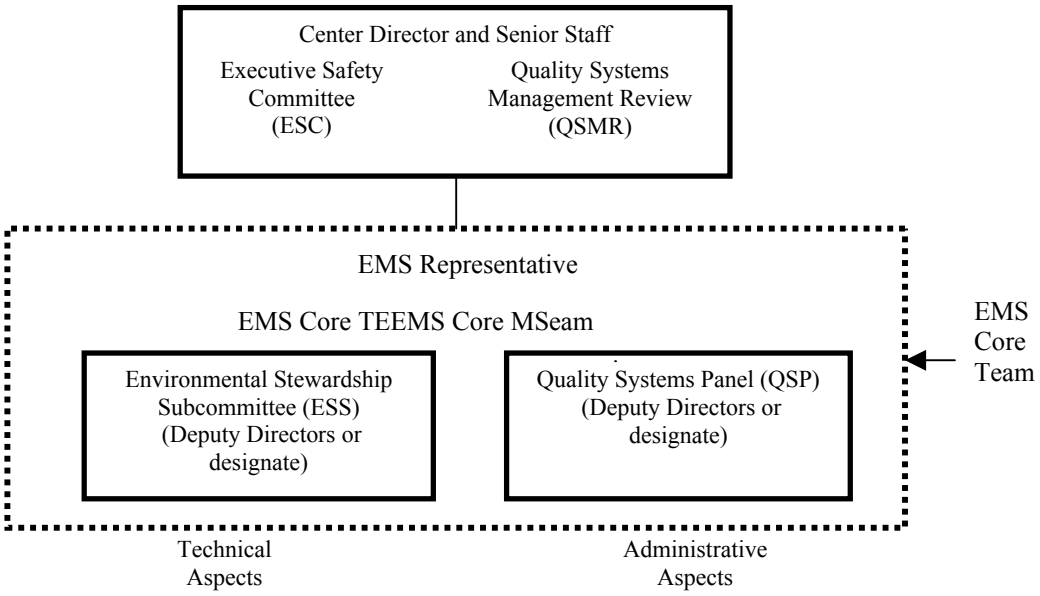
EMS Element	Description of EMS Element
(6) Management Review	Requires a review of the EMS including the policy, and objectives and targets in order to evaluate the suitability, adequacy, and effectiveness. Also requires addressing the need for modifications in light of audit results, changing circumstances, and the commitment to continuous improvement. Senior Management will periodically review the EMS as outlined in Section 3.
(7) Metrics	Requires establishing metrics to track the implementation and effectiveness of the EMS. The EMS Representative will establish metrics in accordance with NASA and JSC guidelines and philosophies.

SECTION 3
Structure and Management of this EMS

3.1 Structure and Management for this EMS

Senior Staff involvement in and review of this EMS will be accomplished during the first year (Implementation Phase) by utilizing two existing mechanisms. The Quality Systems Management Review (QSMR), which oversees the ISO 9000 Quality System, and the Executive Safety Committee (ESC), which oversees the VPP Safety and Health Program, will be utilized to involve Senior Staff, as shown below.

EMS Structure and Management for Implementation



3.2 Center Director/Senior Staff Responsibilities

The Center Director is responsible for the following items under this EMS:

- assigning roles and responsibilities for the JSC EMS Representative;
- providing the authority needed for the EMS Representative to implement and maintain this EMS;
- Providing (or redirecting) resources for the effective operation and maintenance of the EMS; and
- periodically reviewing this EMS for effectiveness and viability.

The Director can execute the above items by assigning these responsibilities to the ESC and QSMR. Upon completing the EMS Implementation Phase during the first year (July 2000 to

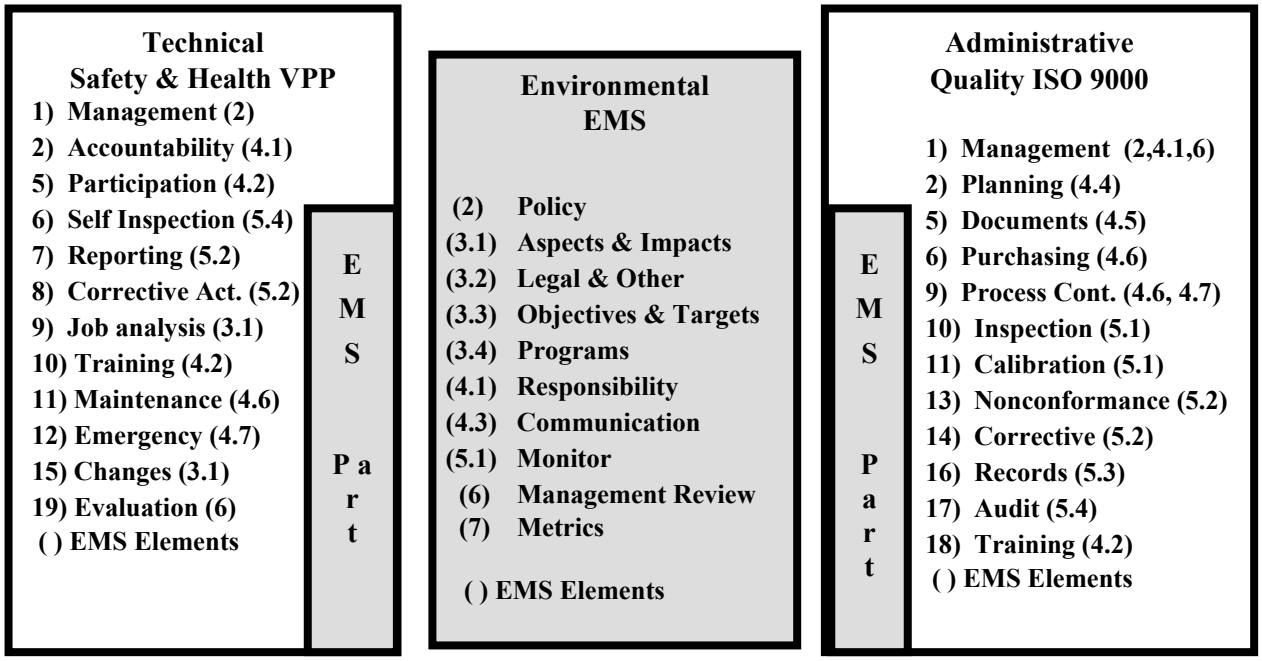
July 2001), the structure and management of the EMS program will be reviewed to evaluate the most effective method of continuing the EMS management.

3.3 ESC Responsibilities

Technical elements of this EMS, which are similar to elements under the VPP Program, will be implemented in coordination with the VPP Program, and will be reviewed by the ESC. The ESC Charter will be modified to specifically include the following responsibilities during the EMS implementation phase:

- reviewing the technical elements of the EMS, including the items shown in the chart below;
- providing final approval of EMS objectives, targets, and programs;
- ensuring that adequate technical resources are available; and
- including EMS issues on the ESC meeting agenda, as necessary.

Technical, Environmental, and Administrative Elements of the EMS



Technical EMS Elements will be implemented in coordination with the VPP Program and reviewed by the Environmental Stewardship Subcommittee and the ESC, as discussed above.

Environmental EMS Elements will be implemented by the EMS Representative in coordination with the Environmental Stewardship Subcommittee and the QSP, as discussed below.

Administrative EMS Elements will be implemented in coordination with the Quality System and reviewed by the QSP and QSMR, as discussed below.

3.4 Environmental Stewardship Subcommittee of the ESC

To support the EMS during the implementation phase, the existing Environmental Stewardship Subcommittee will be restructured to include Deputy Directors or designees of key organizations and contractors that will be impacted by the EMS. The key organizations and contractors may

include representatives of JA, EA, SA, SD, CA, AE, AH, NT, DA (emergency response), BA, and contractor representatives. The Environmental Stewardship Subcommittee Charter will be modified to specifically include the following responsibilities during the EMS implementation phase:

- reviewing the technical elements of the EMS (shown above), and, in particular, impact identification, setting objectives and targets, the corrective action and compliance issues, job analysis, and training, on at least an annual basis;
- ensuring that the EMS is implemented in a technically sound manner. As needed, the Stewardship Subcommittee may form ad hoc-working groups for specific issues to develop recommendations for improvements or corrective actions to the EMS;
- coordinating with their Directorates to disseminate information and obtain input for the EMS program;
- presenting technical issues and recommendations for Senior Staff review during the ESC meetings; and
- coordinating with the ESC to obtain (or reallocate) the necessary technical resources for the proper implementation of the EMS.
-

3.5 QSMR Responsibilities

Administrative elements of this EMS (shown above), which are similar to elements under the ISO 9000 requirements, will be implemented under the Quality System and reviewed by the QSMR. The QSMR Charter will be modified to specifically include the following responsibilities during the EMS implementation phase:

- reviewing the administrative elements of the EMS, including the items shown in the chart above;
- ensuring that adequate human and financial resources are available; and
- including EMS issues on the QSMR meeting agenda, as necessary.

3.6 QSP Responsibilities

To support the EMS during the implementation phase, the QSP Charter will be modified to specifically include the following responsibilities during the EMS implementation phase;

- reviewing the administrative elements of the EMS (shown above) and, in particular, the document system, process control, records, and audits.
- ensuring that the EMS is implemented according to the Quality System and for facilitating timely approval of procedures. As needed, the QSP may form ad hoc working groups for specific issues.
- coordinating with their Directorates to disseminate information and obtain input for the EMS program;
- presenting administrative issues and recommendations for Senior Staff review during the QSMR meetings; and
- coordinating to obtain (or reallocate) the necessary human and/or financial resources for the proper implementation of the EMS.

3.7 EMS Representative Responsibilities

The JSC EMS Representative, designated by the Center Director/Senior Staff, has the authority and responsibility for the overall implementation and management of the EMS during the implementation phase, including the following specific items:

- documenting and communicating roles, responsibilities, and authorities to facilitate effective implementation of the EMS;
- identifying the technical, human, and financial resources necessary for implementing the EMS and providing this information to the COD Director, Environmental Stewardship Subcommittee, and QSP;
- coordinating with the EMS Core Team (the Environmental Stewardship Subcommittee and the QSP) to integrate the EMS into JSC's VPP and Quality programs;
- coordinating with the Environmental Office to obtain assistance;
- ensuring that adequate training on the EMS is provided;
- providing internal communications through a web site and other media, and establishing external communication procedures; and
- assessing and preparing reports for submittal to the Center Director and NASA HQ on the results of the functional assessments, audits, and on the status and viability of the EMS.

The EMS Representative will also be responsible for coordinating with the QSP to schedule audits and designate specific Core Team members to communicate the EMS during an audit. For the EMS elements that are similar to the ISO 9000 elements, the ISO 9000 OPRs will likely serve as the EMS element member. These Core Team members will be responsible for addressing nonconformances that are identified during an audit. The interface with the VPP Program and the ISO 9000 Quality System will be managed by designated Core Team members who are also representatives of those programs.

The EMS Representative will coordinate with the EMS Core Team throughout the implementation phase and provide periodic status reports to the COD Director, as requested. The EMS Representative can delegate responsibilities and utilize outside consulting assistance, as needed.

3.8 Environmental Office Responsibilities

The JSC Environmental Office will maintain responsibilities for managing budgets for environmental programs, providing technical expertise, reporting to agencies, managing institutional environmental compliance and other programs, gathering and analyzing data, and being the contacts for outside audits by regulatory agencies and internal audits by HQ. The Environmental Office will be responsible for assisting to:

- establish and implement the EMS including developing the system level procedures and common work instructions;
- facilitate the environmental aspects and impacts assessments;
- review the environmental objectives, targets and programs;
- establish and monitor the EMS metrics; and
- assist as needed to implement the EMS at JSC.

SECTION 4.0

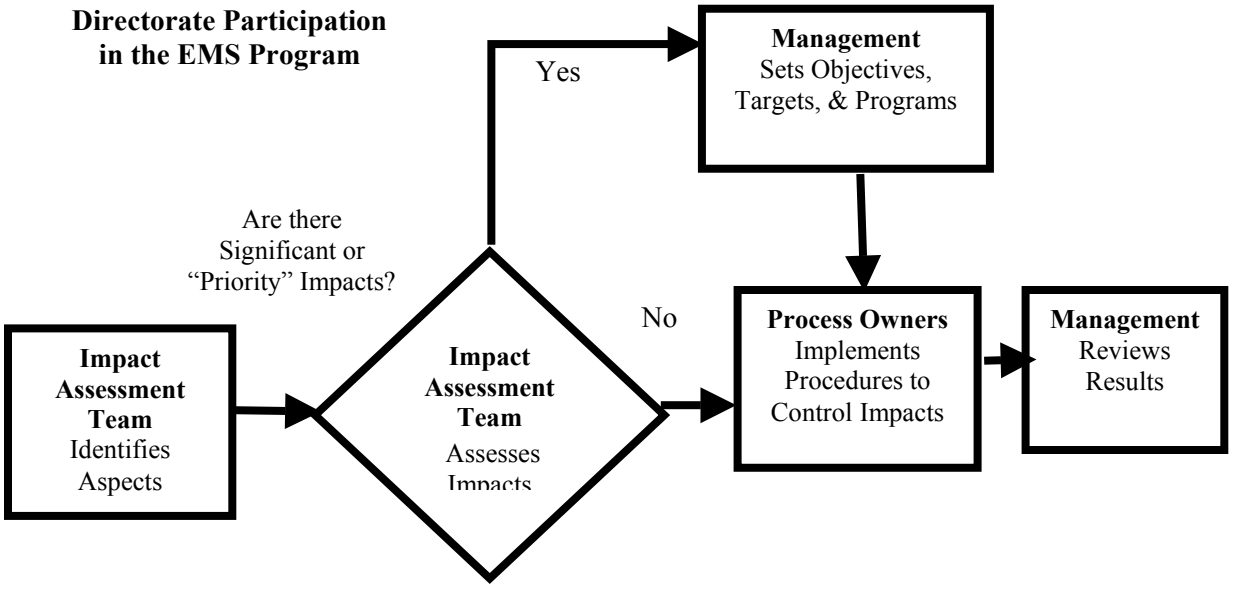
Directorate Responsibilities

4.1 What do the Directorates have to do?

The purpose of the EMS is to control the impact that the Center activities, products, and services have on the environment. Each Directorate has to control their own environmental impacts to ensure compliance, conserve resources, and reduce pollution. The EMS provides a tool to make this more efficient and consistent across the Center. During the EMS implementation phase, the Directorates will be responsible for:

- assisting the EMS Representative to identify EMS Liaisons, and Coordinators as needed, who will manage the EMS implementation within each Directorate;
- allocating (or redirecting) time for personnel to complete EMS training;
- allocating (or redirecting) time for personnel to participate in the impact assessment teams to identify and rate environmental impacts;
- reviewing/developing procedures to control impacts;
- establishing environmental management programs (EMPs) for Priority impacts in their Directorate; and
- implementing or developing procedures or other actions necessary to achieve Center-wide EMPs.

The process for assessing aspects of the activities, products, and services, and controlling environmental impacts is shown below. The steps are discussed in the following sections.



4.2 How are EMS Liaisons and Coordinators designated?

Each Directorate will designate an EMS Liaison who will coordinate with the EMS Representative to implement the EMS within their Directorate. The EMS Representative will assist the EMS Liaison to determine how to divide the Directorate into areas or groups.

The EMS Liaison will then identify Coordinators as needed for each area or group. The Coordinators must be knowledgeable of the activities, products and services in the area, and may be the Facility Manager for a building, or a chief/deputy chief for a specific branch, or the Safety Inspection Team leader or the Contractor Safety Team leader for an area.

4.3 What do EMS Liaisons and Coordinators do?

The EMS Liaisons and Coordinators will receive special training for conducting the impact assessments and for documenting the results in a Center-wide database (EMS Control Plan). The training will include a 2.5-hour training session (includes the EMS Basic Awareness training course). The EMS Liaison will be responsible for ensuring that personnel in their Directorate receive EMS Basic Awareness Training. The EMS Representative will provide all EMS training.

The EMS Liaisons and Coordinators will receive additional on-the-job training in conducting impact assessments and entering data in the EMS Control Plan. The on-the-job training will consist of observing other impact assessment meetings that are facilitated by the EMS Representative or their designated representative. After observing impact assessment meetings, the EMS Liaisons and Coordinators will then conduct meetings in their areas. The EMS Liaisons and Coordinators will also document the results in the EMS Control Plan. The EMS Representative will ensure that the EMS Liaisons and Coordinators have the necessary technical support and assistance.

4.4 How will Impact Assessment Teams be formed?

The process of controlling the environmental impact starts with assembling an impact assessment team. The EMS Liaisons and Coordinators will identify the impact assessment team members. The team members will include a multi-functional team of individuals at all levels, including management, project staff, and administration staff. The EMS Liaison, or their Coordinators, will also schedule the impact assessment meetings, conduct the meetings, and record the data from the meetings into the EMS Control Plan.

4.5 What do the Impact Assessment Teams do?

The multi-functional impact assessment team will meet for approximately one to two hours, depending on the complexity of activities conducted in an area. These meetings will also serve as training for the participants. The team will be provided with the impact assessment procedures and forms. The team will list the environmental aspects of their activities, products and services, both positive and negative.

The same team will review the environmental impacts to see if they could be serious (result in a release that could result in negative impacts to the environment, or personal health or safety, or

could result in a fine). The team also reviews what controls exist to prevent a serious impact and if the controls are adequate.

Most environmental impacts at JSC are common throughout the Center. Therefore, the EMS Representative will group these impacts into "Groups", along with the controls, and these Groups will be listed in the EMS Control Plan. During the impact assessment team meeting, the team can decide to join the Group if they also use the specified controls.

If the impact is not listed as a Group, the team will further evaluate the impact. If the team determines that an impact could be serious, even with the existing controls, then they will formally rate the impact according to the procedures. The team may also establish controls or procedures to prevent an impact from becoming a Priority impact, to minimize a negative impact, or increase a positive impact.

If the team rates an impact as a "Priority" impact, they will forward that information to the EMS Liaison and Directorate Management for further consideration. If the impact is not rated as a "Priority" impact, the information will be documented for further evaluation by the EMS Representative, who is responsible for determining Center-wide "Priority" impacts. The team can also forward other impacts for further consideration by the Directorate Management if they determine that additional controls or management of the impact is warranted.

4.6 How does the Directorate Management manage Priority impacts?

When a team identifies a Priority impact within their area, the Directorate Management will review the impact and consider establishing an environmental management program (EMP). The Directorate Management can also consider establishing EMPs for other impacts, even though they are not rated as a Priority impact, in order to minimize negative impacts or increase positive impacts.

To establish EMPs, the Directorate Management will use the procedures established by the EMS Representative. The EMPs will include the objectives and targets as well as the resources necessary and the schedule for implementation. The Directorate Management can elect not to establish an EMP for a Priority impact, based on several factors such as mission-related issues. However, all EMPs and the decisions not to establish EMPs must be reviewed by the Environmental Stewardship Subcommittee and approved by the Executive Safety Committee.

The Directorate Management will also be responsible for implementing procedures and other actions as necessary to support achieving the objectives and targets of Center-wide EMPs, which are established by the Environmental Stewardship Subcommittee. The Directorate Management will also ensure that personnel receive any specialized training that may be required in areas where there are environmental impacts.

4.7 How do Process Owners control impacts?

Process owners will be responsible for using the controls established in the EMS Control Plan. They will also implement any measuring and monitoring required in the EMS Control Plan.

Process owners who work in areas where there are environmental impacts will also receive additional training specific to their job function.

4.8 What must all JSC Employees and On-site Contractors do?

All JSC employees and on-site contractors will receive EMS Basic Awareness Training. This training outlines JSC's EMS and JSC's Environmental Excellence Policy. The training also emphasizes how to obtain environmental information, and how to report a nonconformance or non-compliance. Personnel who work in an area with controls to prevent impacts will receive additional training as appropriate to prevent and/or control impacts.

4.9 How is the EMS implementation checked?

After the EMS Liaison has completed all impact assessments and documentation in the EMS Control Plan, the EMS Representative will schedule an internal audit for the Directorate. The internal audit will focus on reviewing the EMS Control Plan, interviewing personnel regarding the Environmental Excellence Policy, reviewing training records, and reviewing controls and EMS records. Any actions needed to complete the EMS implementation within the Directorate will be noted and this information will be provided to the EMS Liaison and Directorate Management. The status of implementation within the Directorates will be made available on the EMS web site.

SECTION 5

Implementing and Maintaining the EMS

5.1 Pilot Phase

In order to establish all the EMS procedures, a Pilot Phase will be conducted from July to September 2000. The Pilot Phase will be conducted in an organization that can be physically defined and has several known environmental impacts. During this phase, all of the high level procedures for the 17 EMS elements will be developed and tested. Lessons learned from this trial application will be identified and adjustments will be made, prior to Center-wide implementation.

The EMS Representative, with assistance from JSC's Environmental Office, will develop any new environmental procedures and documentation that do not already exist in order to facilitate the EMS implementation. All procedures will be developed in conformance with the Quality Management System procedures. Procedures in the Safety and Health System that will be utilized to comply with the EMS requirements will be modified as necessary.

New procedures will also include common work instructions that can be utilized throughout JSC for similar activities. The pilot organization and then all other individual organizations can then utilize these procedures, and can modify these procedures or develop unique work instructions as appropriate for site-specific needs.

During the Pilot Phase, the methods of conducting training, communicating, and promoting the EMS on a Center-wide basis will also be developed. To the fullest extent possible, information on the EMS program will be incorporated into the VPP and Quality System training and promotional programs. Information on the EMS will also be provided during routine Division and Contractor meetings. Training materials will be developed to target these and other specific audiences. Training and promotion of the EMS will also include the use of a Web Site, brochures, fliers, and other promotional methods, which will be prepared according to JSC's requirements.

5.2 Implementation Phase

Upon completing the Pilot Phase, the remainder of the Center will begin implementation, one group approximately every 2 to four weeks, until all organizations and facilities have been completed. Directorates will be contacted in advance to identify the EMS Liaison to obtain assistance in dividing the Center into groups or areas and to schedule groups and areas in the most convenient time periods based on workload.

The EMS Liaisons may also appoint Coordinators to assist them. The EMS Liaisons and Coordinators will receive special training in conducting environmental assessments and documenting the results in the EMS Control Plan. The EMS Liaisons and Coordinators will form impact assessment teams including individuals from management, line functions, contractors, facility managers, operations, engineers and others, as appropriate. These teams will

receive training during the impact assessment meetings. The teams will then assess the environmental aspects and impacts of the activities, products and services in each area. The team will also identify or develop the controls for the associated impacts.

Many aspects and impacts are common throughout the Center. The EMS Representative will group these into Groups in the EMS Control Plan. The impact assessment teams can then elect to join a Group if they agree to the controls specified in the EMS Control Plan. If the team determines that there is a unique impact in their area, they will further evaluate the impact and controls and rate impacts that can be serious even with controls. If the impact is rated as a "Priority" impact, the team will forward this information to the EMS Liaison and Directorate Management. The team can also forward information on other impacts if they determine that additional actions may be warranted to prevent an impact from becoming a Priority impact, to minimize a negative impact, or to increase a positive impact.

The Directorate Management will then consider establishing an environmental management program (EMP) for each Priority impact unique to their organization. The Directorate Management can decide not to establish an EMP based on considering several factors, such as mission-related requirements. However, all EMPs and decisions not to establish EMPs will be forwarded to the Environmental Stewardship Subcommittee for review.

The EMS Representative will review all impacts to identify those that could be a Priority impact based on cumulative Center-wide impacts. The EMS Representative, with the assistance of the Environmental Office, will also identify regulatory compliance-driven issues that may also warrant an EMP. This information will be forwarded to the Environmental Stewardship Subcommittee for review.

The Environmental Stewardship Subcommittee will review EMPs established by the Directorates and will forward these to the Executive Safety Committee for approval. The Environmental Stewardship Subcommittee will also review Center-wide impacts and other impacts forwarded by the EMS Representative to establish EMPs as determined necessary. The Environmental Stewardship Subcommittee will forward these to the Executive Safety Committee for approval.

The EMS Representative (and the Environmental Office or their support contractor) will assist the organizations during the EMS implementation. The EMS Representative will also provide for EMS auditor training and will conduct internal audits to review the implementation within each Directorate and provide the audit findings to the EMS Liaison and Directorate Management. The EMS Liaison will be responsible for implementing any needed actions to complete the EMS implementation.

The EMS Representative will also ensure that EMS procedures are established and/or modified as needed during the implementation. The EMS Representative will also coordinate with the EMS Core Team to facilitate approval of all procedures. These procedures include the EMS System Level Procedures (SLPs) as well as environmental compliance common work instructions (CWIs).

5.3 Audits/Nonconformance and Noncompliance

Since JSC has volunteered to implement the EMS in accordance with the NASA EMS Procedures Manual, NASA Headquarters (HQ) will hire an ISO 14001 auditor to conduct the two-stage registration audit. This audit will help the agency evaluate and develop an agency-wide EMS. In addition, HQ will conduct functional audits once every three years to help provide Centers with assurance that their programs are compliant with regulations. Other internal audits will be conducted as deemed necessary by the JSC Environmental Office. Outside regulatory agencies also inspect JSC for compliance.

Non-conformances will be entered into JSC's Quality Performance Improvement Database (QPID) system, as appropriate, to track corrective action. Non-compliances can also be reported through the existing Hazard Abatement Tracking System (HATS). The Environmental Office will review non-compliances and non-conformances to determine if corrective action or preventive action is required.

A continuing set of "lessons learned" will be maintained to help other NASA Centers, help JSC in future efforts, and help the implementation team improve efficiency and effectiveness.

5.4 Post-Implementation Maintenance and Continual Improvement

Upon completing the Center-wide implementation, several activities will be required to sustain the EMS. Sustaining the EMS will primarily revolve around the following items.

- **Conducting on-going training and awareness**. The EMS web site and other communication methods can be utilized to provide on-going training and awareness on the EMS.

- **Conducting on-going impact assessments**. The EMS procedures and Safety and Health procedures include provisions for when and how additional impact assessments will be required. The Environmental Office will also evaluate the need for additional impact assessments based on new or different regulatory or other environmental requirements.

- **Implementing EMPs**. The EMPs will be periodically reviewed to ensure that the objectives and targets are achieved in a timely manner and to make modifications when necessary due to new activities or new requirements. New EMPs will also be established when needed to achieve compliance-driven objectives and targets.

- **Conducting audits.** Audits will be conducted to ensure conformance with the EMS procedures and to identify and correct nonconformances and non-compliances.

- **Conducting management review.** The results of audits and EMPs will be reviewed on a periodic basis by management in the EMS Core Team. The management reviews will ensure that EMS is suitable, adequate, and effective and that there is continual improvement according to JSC's Environmental Excellence Policy.

Appendix
Definition of Terms

Appendix
JSC's Environmental Policy

EMS Implementation Schedule (March 2000 – June 2001)

Description Of Activity	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	++
PreImplementation																	
Conduct a gap analysis and determine requirements for the implementing the EMS																	
Conduct training for the Environmental Office and Form an EMS Strategy Team																	
Determine the structure required for an EMS at JSC and develop an Implementation Plan																	
Obtain management approval of the Implementation Plan and Schedule																	
Pilot Phase																	
Develop procedures while simultaneously Completing a Pilot Phase in one area																	
Implementation Phase																	
Form and EMS Core Team and restructure the existing Envr Stewardship Subcommittee																	
Conduct Center-wide awareness training																	
Conduct Center-wide impact assessments																	
Establish objectives and targets and programs, and review by management																	
Set operational controls and conduct specific job training																	
Post-Implementation Phase																	
Review and evaluate the EMS implementation phase and establish metrics & Conduct Audit																	
Register under ISO 14001																	
Continue aspect assessments for new conditions and implement continuous improvement																	

Appendix E
Stennis Space Center
EMS Implementation Plan

John C. Stennis EMS Implementation Plan

Phase I: Preliminary Assessment- EMS Contractor staff will conduct an initial site-visit to familiarize themselves with the Stennis facility and management and assist with the selection and development of an implementation team (Core Team) and Environmental Coordinator. During this visit the EMS Contractor will also review EMS work done at Stennis to-date (e.g. gap analysis, EMS manual). A second visit is required by the contractor to attend and assess the awareness training (includes aspect identification) provided by NASA Headquarters Contractor allowing staff the opportunity to familiarize themselves with their implementation methodology and personnel. This phase will be conducted over a one-month period.

Phase II: Establish EMS Framework- Phase II will be conducted over a three-month period. During this time, the EMS Contractor will work with the Stennis Environment Office and selected personnel to establish the framework for the EMS. At the end of Phase II, the following tasks will be completed:

- Provide top management an overview of the project and discuss the commitment required for the EMS implementation.
- Select EMS Core Team - the following functions should be considered:
  - operations - maintenance
  - legal - communications
  - health & safety - administration
- Deliver EMS awareness workshops and "refresher courses" where needed for project personnel including a(n):
  - Introduction to the EMS concept
  - Comprehensive overview of implementation issues
  - Review of the relevant EMS implementation tools (e.g. implementation schedule, environmental aspects assessments, and procedures development)
  - Overview of roles and responsibilities
- Identify Center environmental aspects
  - Compile a list of environmental interactions by functional units; determine which are priority impacts
- Determine legal and other requirements to which the organization subscribes and develop a procedure
- Integrate activities with ISO 9000 where appropriate

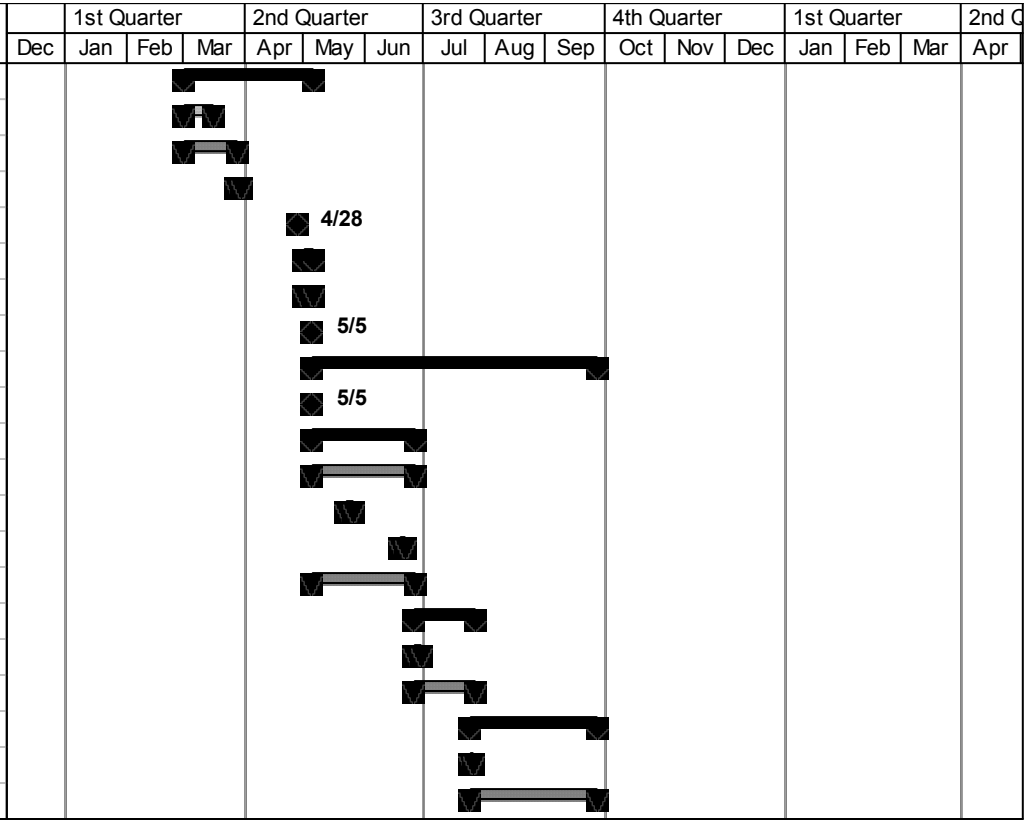
Phase III: Plan Activities of EMS- Phase III will be conducted over a four-month period. During this time EMS Contractor will work with the EMS Core Team to develop environmental management programs to help fulfill the environmental policy. At the end of Phase III, the following tasks will be completed:

- Provide Objective & Target Training
- Provide Environmental Management Program (EMPs) Training and review the importance of operational controls
- Formulate a plan to fulfill the environmental policy which will:
  - Develop Environmental Management Programs (EMP's) to achieve the objectives and targets
  - Determine the necessary operational controls
  - Select indicators of performance for monitoring and measuring progress
- Define, document, and communicate staff roles, responsibilities and authorities
- Examine existing documentation processes: analyze types of documents, storage locations, who needs access, and how they are controlled
- Integrate Remote Sensing EMS activities with Stennis facility EMS
- Conduct Center-wide EMS awareness meetings involving all personnel and review the Center's environmental policy

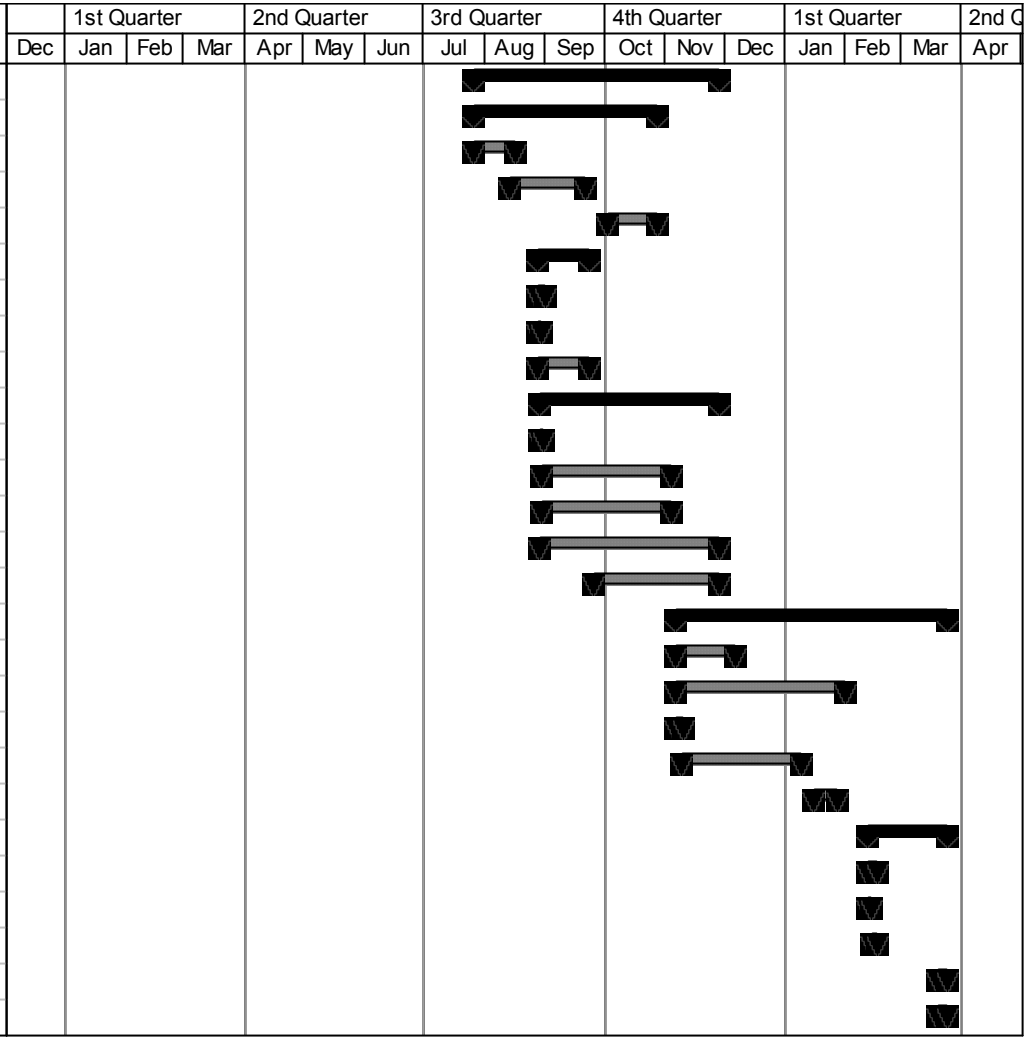
Phase IV: Implementation of EMS- Phase IV will be conducted over a four-month period. During this time the EMS Contractor will work with the EMS Management Team to assist with the implementation of the environmental management programs and procedures. EMS Contractor will also assist with efforts to perform checking and corrective actions on the EMS. At the end of Phase IV, the following tasks will be completed:

- Implement the Plan (EMPs) from Phase III
  - Determine structure and responsibility
  - Ensure the employees are trained and capable of carrying out their environmental responsibilities
  - Ensure effective management of procedures and other systems documents
  - Identify, plan and manage operations and activities in line with policy, objectives and targets
- Identify potential emergencies and develop procedures for preventing and responding to them
- Check activities and provide corrective action if necessary
  - Monitor key activities and track performance
  - Identify problems and prevent recurrences
  - Keep adequate records of EMS performance
- Provide Internal Audit Training
- Conduct Internal Audit
  - Determine through a planned and documented assessment whether the requirements of the EMS are being met
- Conduct a Management Review
  - Periodically review the EMS for purposes of continual improvement
- Finalize EMS Manual
- Collect and analyze data about the EMS development process, associated costs, accrued benefits, and lessons learned

ID	Task Name	Start	Finish
1	**Phase I: Preliminary Assessment**	**Wed 3/1/00**	**Fri 5/5/00**
2	Review Existing Materials	Wed 3/1/00	Wed 3/15/00
3	EMS Core Team Recommendations	Wed 3/1/00	Mon 3/27/00
4	Site Visit	Mon 3/27/00	Wed 3/29/00
5	Finalize Core Team	Fri 4/28/00	Fri 4/28/00
6	**Assess HQ Awareness Training**	**Mon 5/1/00**	**Fri 5/5/00**
7	Site Visit	Mon 5/1/00	Fri 5/5/00
8	Provide additional training as needed	Fri 5/5/00	Fri 5/5/00
9	**Phase II: Establish EMS Framework**	**Fri 5/5/00**	**Tue 9/26/00**
10	Finalize Fenceline	Fri 5/5/00	Fri 5/5/00
11	**Environmental Aspect Identification**	**Fri 5/5/00**	**Mon 6/26/00**
12	Env. Aspect Identification	Fri 5/5/00	Mon 6/26/00
13	Site Visit	Mon 5/22/00	Thu 5/25/00
14	Site Visit	Mon 6/19/00	Wed 6/21/00
15	Develop legal & reg. Requirement procedur	Fri 5/5/00	Mon 6/26/00
16	**Identify Priority Impacts**	**Mon 6/26/00**	**Wed 7/26/00**
17	Site Visit	Mon 6/26/00	Thu 6/29/00
18	Finalize list of priority impacts	Mon 6/26/00	Wed 7/26/00
19	**Develop a documentation plan**	**Mon 7/24/00**	**Tue 9/26/00**
20	Site Visit	Mon 7/24/00	Tue 7/25/00
21	Integrate Activities with ISO 9001	Mon 7/24/00	Tue 9/26/00



ID	Task Name	Start	Finish
22	**Phase III: EMS Planning Activities**	**Wed 7/26/00**	**Mon 11/27/00**
23	**Facility-wide EMS Awareness Training**	**Wed 7/26/00**	**Fri 10/27/00**
24	Identify EMS Champions	Wed 7/26/00	Wed 8/16/00
25	Develop training film	Mon 8/14/00	Wed 9/20/00
26	Conduct training	Mon 10/2/00	Fri 10/27/00
27	**Objectives & Targets**	**Mon 8/28/00**	**Fri 9/22/00**
28	Site visit	Mon 8/28/00	Thu 8/31/00
29	Obj. & Target Training	Mon 8/28/00	Tue 8/29/00
30	Establish Objectives & Targets	Mon 8/28/00	Fri 9/22/00
31	**Environmental Management Programs**	**Tue 8/29/00**	**Mon 11/27/00**
32	EMP Training	Tue 8/29/00	Wed 8/30/00
33	Establish EMPs	Wed 8/30/00	Fri 11/3/00
34	Identify personnel EMS roles and responsil	Wed 8/30/00	Fri 11/3/00
35	Insure documentation is conformant w ith IS	Tue 8/29/00	Mon 11/27/00
36	Integrate remote sensing activities	Mon 9/25/00	Mon 11/27/00
37	**Phase IV: EMS Implementation**	**Mon 11/6/00**	**Fri 3/23/01**
38	Insure training and capability of employees	Mon 11/6/00	Wed 12/6/00
39	Implement EMPs	Mon 11/6/00	Wed 1/31/01
40	Site Visit	Mon 11/6/00	Thu 11/9/00
41	Insure effective operational controls	Thu 11/9/00	Mon 1/8/01
42	Identify potential emergencies and develop proc	Mon 1/15/01	Fri 1/26/01
43	**Internal Audit**	**Mon 2/12/01**	**Fri 3/23/01**
44	Site Visit	Mon 2/12/01	Fri 2/16/01
45	Internal Audit Training	Mon 2/12/01	Tue 2/13/01
46	Conduct preliminary internal audit	Wed 2/14/01	Fri 2/16/01
47	Site Visit	Mon 3/19/01	Fri 3/23/01
48	Top Management Review	Mon 3/19/01	Fri 3/23/01



Appendix F
Lessons Learned

NASA EMS IMPLEMENTATION LESSONS LEARNED

This series of notes are a summary of lessons learned and suggestions from the three test bed NASA Centers as EMS implementation nears completion. The content of this document includes lessons learned and hints for other NASA Centers to use in the implementation of an EMS.

The lessons learned are grouped primary EMS elements of Planning, Implementation, Checking/Corrective Action, Management Review a General catch all and Contractor Support for lessons on how to make the help you get work best for your Center. Lessons learned from all three centers are combined.

PLANNING

- Get Management commitment to more than participation in the annual review process. Management involvement needs to be visible across the Center, throughout the implementation process.

- Expect to spend a lot of time planning. JSC spent March to October. Glenn had 7 months of delays in getting the right documentation in place. Lesson here is it will take time, but be sure to be going after the right plans that are well thought out and will work at your Center.

- Integrate the EMS into existing systems (ISO 9000 being a primary one but also general business management processes at the Center). The integration may result in additional work for the implementation team due to some initially increased complexity but will reduce work for center staff in general. This is a benefit that internal organizations at Centers have recognized and insisted on.

- Need to know the existing management systems and ISO 9000 system in detail before trying to build the EMS (Government and EMS contractors).

- Before you begin implementing the EMS, know NPG 8553.1 and ISO 14001 very well. This means both the text and what the text will require you to do.

- Go and see how others who have done an EMS, did theirs before you start. Go and see how they did it or bring someone to your Center from a Center who has done it to help with the learning curve.

- Have the Environment Office get training at the start of the project. Auditor training to understand what and auditor would be looking for and Implementation training to understand how to build it.

- The Core Team needs to include members representing different organizations across the Center. Glenn brought together representatives from each organization at that Center. This group did the planning and aspects identification not the environmental office. As a result they got involved in the EMS and began thinking beyond just compliance.

- When setting objectives and targets, keep them simple and achievable. Glenn has noted that even a simple target like getting 100% of material handlers spill trained can be a challenge.

- Top management buy-in for targets is key to getting staff to do things.

- Tailor the approach to the Center.

IMPLEMENTATION

- As implementation proceeds, be sensitive to the need to be proactive in letting people know what is going on. Look for ways to inform them of what is going on to work getting them involved.

- Contractor involvement in the EMS is key. The degree of effectiveness of the EMS is linked to the degree of contractor involvement.

- On line training / awareness building activities is recommended and may be the only way at some Centers to get participation and build awareness. Video based training also works. The degree of awareness activities needed is dependent on existing awareness levels.

- As implementation proceeds the team needs to have a level of authority to make one level of changes and ready access to a higher level management team when their review or approval in needed. The implementation process needs to keep management involved for this to work and they need to work to ensure that cross organizational issues are identified and dealt with.

- JSC found it's process of making each Directorate get involved in defining it's part of the EMS resulted in ownership of the EMS at that level. Less reliance in the short term on Environmental Office staff was observed as well as it is expected in the long term. This model appears to one worth serious consideration at larger and decentralized Centers where Directorates operate their own programs to a significant degree.

- Getting buy-in is important as the process goes forward. Can you get as much grass roots support as the ISO 9000 and OHSA VPP programs? This will only happen if people outside of the Environmental Office take on responsibility.

- At Glenn Management got everyone to attend training. This helped a lot.

- Communication needs to be web based and interactive. Look for ways to use existing Center communication vehicles to build awareness.

- Glenn used employee suggestions for environmental items that even if off topic allow for greater visibility of the program and allow the Environmental Office to highlight thing s that are already being done. Stennis and Glenn both found that special promotions and reminders were useful (t-shirts and ID badge tags) in building awareness.

- Have a high visibility implementation program. Glenn found that high visibility got greater interest building in the program.

- Stennis found that starting the EMS awareness training early didn't work to well for the average Center resident (Governmental and Contractors). The training (both awareness and more detailed implementation) was needed for the EMS core team at the start of the project.

- Documenting what actually has to be done makes staff in general more aware of what everyone has to do. People can more easily see their role as a result.

- It is important to do the documentation on the intranet to keep it manageable.

CHECKING/ CORRECTIVE ACTION

- The JSC approach that uses Directorates to do a lot of the detailed implementation work does require added diligence to ensure that all directorates are doing their part and that they understand the EMS.

- In the past Metrics were organizational measures. The impact reduction stress of targets has a different and positive effect on perception.

- Internal auditor training involving the ISO 9000 staff is a good resource use but also need to include non ISO 9000 staff as EMS auditors.

- It would be good to have at least a couple of Center staff trained in EMS Auditing early in the planning process so that they can look at the EMS as it is designed from an auditor's perspective. This should reduce EMS rework once the internal audit process begins (Note: External opinions of the third party auditor helped but the internal audit members saw things that the external parties did not).

- Finding the flaws in the existing state of environmental management takes time and detailed review that a GAP assessment at the start of planning may not catch. Be prepared to be checking as you implement and expect to have to make some adjustments.

- If possible, find staff or contractor time to build in a few checks and balances into the EMS development process.

- Stennis noticed that once the internal audit resulted in CARS (corrective actions were required), that the EMS got a higher profile. Since CARS where an ISO 9000 system, Center management knew what they were and reacted.

- Compliance audit results from the Functional Review program can be used for the EMS project as an input as well as feedback.

MANAGEMENT REVIEW

- Use of a group of the right people to make EMS planning decisions is a must. The core team needs to have the authority to make decisions. Note: The decision making team may not be the same as the day to day implementation team. A small or separate team to get day to day implementation done is also key (smaller Centers may find that this team be only one to three people).

- Get buy-in from upper level Center Management. Just informing upper level staff of EMS project does not necessarily constitute commitment. Upper management need to ensure that the message they send out is that the EMS project is important. Failure to do this can result in negative ripple effects resulting in the need to re-initiate the project kick off and consume additional time and resources on the part of the implementation team.

- Having upper management approve the steps for the program rather than just at the end of implementation keeps them involved and allows for greater visibility.

GENERAL

- Any changes to NASA level guidance documents need to be complete before Centers hire contractors to assist with the implementation project. Use the most up to date versions of EMS guidance materials.

- Try to avoid EMS implementation during times of upper management turmoil. If this is not practical recognize added effort to coordinate and work with areas in flux will be needed. JSC was reorganized near the end of it's EMS implementation and as a result the EMS project was put on hold [easy to stop but hard to regain momentum].

- No matter what Contractor you get to assist you with the EMS project they will need a portion of key Governmental Environmental staff time to work on NASA issues for the project. Thus plan on this into how you structure your contractor arrangements and when determining time key environmental staff will spend on the project. All three Centers noted that the EMS implementation took a lot more of key Environmental Office staff time than they had originally expected it to

- Consider whether the EMS lead / EMS Representative needs to have a portion of their normal position backfilled for the duration of the EMS implementation. If this form of support is appropriate (and it may or may not be depending on the normal responsibilities if of the EMS Representative), do it ASAP and not during crunch time.

- The process of evolution of existing ISO 9000 systems from the 1994 standard to the ISO 9000 –2000 standard adds another layer of stress to the organization that needs to be recognized if it is ongoing while EMS implementation is occurring.

CONTRACTOR SUPPORT

- Be sure the Contractor understands the goals of your Center and how the Center views the project from the perspective of just meeting ISO Registration requirements versus, long term sustainability of the EMS. Where does the Center see Value in the EMS?

- Define the EMS Endpoint and what "more than ISO" means to your Center as part of knowing where you are and knowing where you want to go.

- Your contractor has to learn and understand how your existing management systems (ISO 9000 especially) work in detail before they begin to work on EMS to be sure it is designed to be integrated.

- Your contractor has to understand (or take the time to learn early in the project) the history and culture of your Center in order to be effective.

- Having a local assistance provider can be beneficial. One alternative would be a provider that puts someone in place on-site for 6 to 9 months (9 months being the time period of intense work an EMS could possibly be completed at a Center). Having a primarily remotely based contractor for the project can result in them not being adaptable or aware enough of what is happening at the Center. The contractor needs to be there to effect change.

- However resourced, keep the contractor team small and concentrated (one or two people). Also expect that there will need to be one key governmental person (most likely the EMS representative) who has to function as a final filter on if all the pieces are in place and that the various documents work together.

- Regular, possibly weekly, face to face meetings with the contractor to ensure the EMS Representative and they are in the loop are a good idea.